United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
United States
Department of Agriculture,
Forest Service,
Louisiana Agricultural
Experiment Station,
Louisiana Soil and
Water Conservation Committee

Soil Survey of Natchitoches Parish, Louisiana

How To Use This Soil Survey

General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This soil survey was made cooperatively by the Soil Conservation Service and United States Department of Agriculture, Forest Service, the Louisiana Agricultural Experiment station, and the Louisiana Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Natchitoches Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Clear flowing streams that have outcroppings of sandstone and siltstone bedrock, such as the Kisatchie Bayou, are unique to the area of the Catahoula and Fleming Formations in southwestern Natchitoches Parish.

Contents

Index to Map Units

Summary of Tables

Foreword

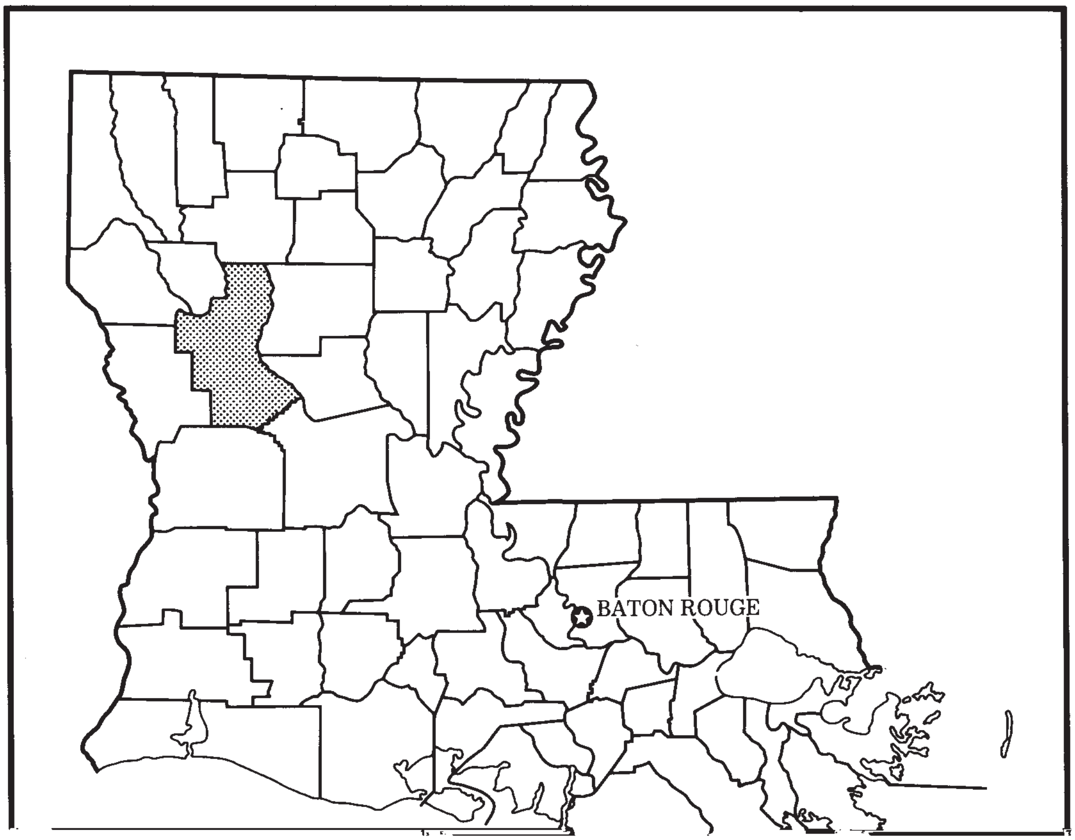
This soil survey contains information that can be used in land-planning programs in Natchitoches Parish. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Horace J. Austin
State Conservationist
Soil Conservation Service


BATON ROUGE

Soil Survey of
Natchitoches Parish, Louisiana

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History and Development

The Red River, flowing through the heart of Natchitoches Parish, carries with it the history and development of the parish and its land.

The city of Natchitoches is the oldest settlement in the Louisiana Purchase. It was founded on the banks of the Red River in 1714 by the French explorer, Louis Juchereau de St. Denis.

Red River, an early trading post, was established by the French to facilitate trade with the Spanish to the west of the Red River. Local people also used this trading post to carry on commerce with others in the lower Mississippi Valley.

During the 1720's, the Spanish settled just outside the present-day town of Robeline in west Natchitoches Parish. The Spaniards called this settlement Los Adeas. Los Adeas served as the capital of Spanish Texas. An illicit commerce soon developed between Natchitoches and Los Adeas.

The land along the Red River provided livelihood for many temporary and permanent residents of Natchitoches Parish. Fur trappers brought hides, skins, and furs to local trading posts or transported them to New Orleans for sale. The fur business contributed much to the economy of the parish, but it also disrupted life on this frontier and slowed the settlement of family farmers and other pioneers. The fur trappers and traders provided a dangerous and unsettled environment to other pioneers because of their "dissolute habits." Natchitoches was the center for fur trading during Spain's control of Louisiana following the territory's transfer from the French in 1763.

Indigo and tobacco were important crops during most of the 18th century. Planters received handsome profits from the sale of these crops. Toward the end of the century, tobacco declined somewhat in importance in Natchitoches Parish, partly because of competition by tobacco farmers from Kentucky.

Cotton became the major crop in Natchitoches Parish soon after Eli Whitney developed the cotton gin in 1790. The cotton gin provided an efficient method of separating the cotton seed from the fiber. Some of the richest cotton land in the south is on the flood plains of the Red River and Cane River in Natchitoches Parish. Many fortune seekers immigrated from east of the Mississippi River to Natchitoches Parish, and the cultivation of cotton fields led to the development of plantations. Some of the plantation homes survive today as gracious reminders of Natchitoches Parish's antebellum past.

With the coming of the Civil War in 1864, Natchitoches Parish experienced war's destructiveness, mostly because of the Red River Campaign. During this time, parish farmers and planters witnessed the destruction of their crops. Rebuilding followed in the wake of war, and cotton continued as the major crop and supported the parish's economy into the second half of the twentieth century.

Natchitoches enjoys industrial growth along with a continued reliance on agriculture. Northwestern State University and the Louisiana School of Math, Science, and the Arts are in Natchitoches and establish the city as one of the state's major educational centers.

The residents of Natchitoches Parish are very conscious of the region's historical heritage. Tours of antebellum homes within the city and along the Cane River are conducted each fall. Fort Saint John de Baptist has been restored to uncover an earlier history of the parish. The Fort Festival and the Christmas Festival attract tourists each year from all over the world.

Agriculture

Agriculture is the dominant land use in Natchitoches Parish. In 1986, the average farm was about 367 acres. The number of farms in the parish is decreasing, and the average size is increasing.

Cropland acreage has shown little change. The value of agricultural products produced annually in the Natchitoches Parish is between 60 and 70 million dollars. In 1985, about 21,000 acres of cotton, 35,000 acres of soybeans, 9,000 acres of wheat, and 4,000 acres of corn were planted in the parish. Small acreages of grain sorghum, oats, and other crops were also planted. Hayland and pastureland make up about 100,000 acres in the parish. Common bermudagrass, Coastal bermudagrass, and Alicia bermudagrass are the principal grasses grown for hay and pasture.

About 63 poultry farmers in the parish raise over a million birds. Forestry is a big income producer with about 620,000 acres of commercial woodland. Many small to large pecan orchards are on the Red River bottom land. About 500 acres is used to produce crawfish.

The present trend in Natchitoches Parish appears to be an increase in the acreage planted to grain sorghum and a decrease in the acreage planted to soybeans. In recent years, the construction of good farm-to-market roads, modern grain elevators and cotton gins, and the improvement of drainage systems have strengthened the production and marketing abilities of farmers in the parish.

All of the industries in the parish are agriculturally based. They support the production and marketing of poultry, forest products, and cottonseed oil and by-products.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Natchitoches in the period 1951 to 1973. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 51 degrees F, and the average daily minimum temperature is 39

Landscape Resources

The Natchitoches Parish landscape is changing because of woodland clearings, different methods of cultivating and planting, urban expansion, and utilities. Stripmining may become commonplace in some parts of the parish.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants

same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses. Soil scientists interpreted the data from these analyses as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or a building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their suitability for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the suitability of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil suitability ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, pasture, woodland,* and *urban uses,* . Cultivated crops are those grown extensively in the survey area. Pasture refers to

each of the broad groups and the map units in each group follow.

Dominantly Level and Nearly Level, Loamy Soils; on Flood Plains

This group of map units consists of well drained and poorly drained soils that are loamy throughout. The three map units in this group make up about 16.5 percent of the parish. Most areas that seldom or never flood and some areas that flood occasionally are in crops or pasture. Most areas that flood frequently and some areas that flood occasionally are woodland. Seasonal wetness and the hazard of flooding are the main limitations for most uses.

1. Roxana-Gallion

Level, well drained soils that are loamy throughout; formed in Red River alluvium

In this map unit, the landscape typically has very little relief. It is level flood plains and consists of high ridges or natural levees adjacent to the Red River and former channels and distributaries of the Red River. Slopes are 0 to 1 percent. Streams are mostly permanent and flow in meandering courses. The soils are protected from flooding by a network of levees. Many farmsteads, homes, and several cities and villages are prominently visible within the broad expanses of open farmland. The degree of visual variety is generally low.

This map unit makes up about 6.5 percent of the parish. It is about 49 percent Roxana soils, 45 percent Gallion soils, and 6 percent soils of minor extent.

and Gallion soils and are clayey and somewhat poorly drained. The Caspiana soils are in intermediate positions, and the Severn soils are in positions similar to those of the Roxana soils. The Caspiana and Severn soils are loamy and well drained.

suited to use as pasture. Flooding limits the choice of crops and pasture plants and can delay or prevent planting or harvesting in some years. The frequently flooded soils are poorly suited to these uses.

period of grazing are limited by soil wetness and the frequency and duration of flooding.

These soils are poorly suited to most urban uses because of flooding and wetness.

Dominantly Level and Gently Undulating, Clayey and Loamy Soils; on Flood Plains

This group of map units consists of somewhat poorly drained and very poorly drained soils that have a clayey or loamy surface layer and a clayey or loamy subsoil. The two map units in this group make up about 20 percent of the parish. Most of the soils that are rarely or

for cultivated crops or pasture. Soybeans and grain sorghum are the main crops. The frequently flooded Moreland and Yorktown soils are used as woodland for timber production and as wildlife habitat.

The frequently flooded Moreland soils are poorly suited to cultivated crops and pasture. The Yorktown soils are not suited to crops. The occasionally flooded Moreland soils are somewhat poorly suited to crops and are moderately well suited to use as pasture. Wetness and the hazard of flooding are the main limitations. Choice of crops and pasture grasses and the period of grazing are limited because of wetness and the clay. The subsoil is reddish brown, mottled silty clay loam.

clearcuts for timber or right-of-way for utilities, will produce high contrast layer and a loamy and clayey subsoil. The five map units

The soils in this map unit are mainly used as loam. The lower part of the subsoil and the substratum are light brownish gray, mottled clay.

The Wrightsville soils are level and poorly drained. They are on broad flats and in depressional areas. The surface layer is dark grayish brown silt loam, and the subsurface layer is light grayish brown, mottled silt loam. The subsoil is light brownish gray, mottled silty clay loam and clay. The substratum is reddish brown clay.

Of minor extent are the Guyton, Keithville, Shatta, and Morse soils. The Guyton soils are in drainageways and on broad flats. They are poorly drained. The Keithville and Shatta soils are in higher positions than the Gore, Acadia, and Wrightsville soils, and they are moderately well drained. The Morse soils are on strongly sloping side slopes and are well drained.

The soils in this map unit are mainly used as woodland. Small acreages are used for pasture or cultivated crops.

The soils in this map unit are moderately well suited to use as woodland. The potential productivity of loblolly pine and hardwoods is high. Logging operations during winter and early in spring are limited by wet soil conditions. Erosion is a hazard along logging roads and skid trails in the gently sloping areas.

These soils are moderately well suited to cultivated crops and well suited to use as pasture. Wetness is a limitation on nearly level soils, and erosion is a hazard on the gently sloping soils. Where these soils are used for crops, conservation tillage, contour farming, and grassed waterways can minimize soil losses from erosion. Surface drainage is needed for the level and nearly level soils. Lime and fertilizer are needed for crops and pasture.

These soils are poorly suited to most urban uses. Wetness, very slow permeability, and the high shrink-swell potential are the main limitations.

9. Shatta

Gently sloping, moderately well drained soils that are loamy throughout; formed in old stream deposits

In this map unit, the landscape typically has slight to moderate relief. It is long, smooth slopes on interstream

The Shatta soils have a brown very fine sandy loam surface layer and a pale brown very fine sandy loam subsurface layer. The subsoil is strong brown and yellowish brown clay loam in the upper part. It is at a depth of 32 inches. The fragipan is yellowish brown loam and clay loam.

Of minor extent are the Acadia, Gore, Guyton, and Ruston soils. The Acadia and Gore soils are in lower positions than the Shatta soils. The Acadia soils are somewhat poorly drained, and the Gore soils are moderately well drained. The Guyton soils are in drainageways and are poorly drained. The Ruston soils are in higher positions than the Shatta soils and are well drained.

The soils in this map unit are used about equally as woodland and pasture. Small acreages are used for cultivated crops or homesites.

These soils are well suited to use as woodland. The potential productivity of loblolly pine and shortleaf pine is high. These soils have few limitations for woodland use and management.

These soils are moderately well suited to cultivated crops and well suited to use as pasture. The hazard of soil erosion is a limitation in most areas, but conservation tillage, contour farming, and grassed waterways can minimize soil losses. Fertilizer and lime are generally needed for crops and pasture.

These soils are moderately well suited to most urban uses. Wetness and slow permeability are the main limitations.

10. Anacoco-Malbis

Gently sloping, somewhat poorly drained and moderately well drained soils that have a loamy surface layer and a loamy or clayey subsoil; formed in old stream and marine deposits

In this map unit, the landscape typically has slight to moderate relief. It is long, smooth slopes on interstream divides of the uplands and broad ridgetops and gentle side slopes. Slopes range from 1 to 5 percent. The heads of numerous shallow drainageways lead from mottled clay. The substratum is light olive gray clay that has common thin strata of siltstone.

The Malbis soils are moderately well drained. The surface layer is grayish brown fine sandy loam, and the subsurface layer is yellowish brown fine sandy loam. The subsoil is brownish and yellowish loam and sandy clay loam in the upper part and mottled grayish and reddish sandy clay loam in the lower part.

Of minor extent are the Betis, Ruston, Kisatchie, Oula, and Guyton soils. The Betis and Ruston soils are on high ridgetops. The Betis soils are somewhat excessively

ridgetops and strongly sloping side slopes on uplands. Narrow flood plains border incised, meandering, mostly intermittent streams. The landscape is dissected by a well-defined, branching drainage system. Slopes range from 1 to 12 percent. Land use is mainly woodland of pines with intermingled hardwoods. Scattered, small open areas are pasture. Narrow corridors of open space are provided by rights-of-way for utilities. Scattered, small to large clearcuts for timber also create interesting open areas. The degree of visual variety is moderate.

high shrink-swell potential. Slope is a limitation in some areas.

12. Sacul-Keithville

Gently sloping to strongly sloping, moderately well drained soils that have a loamy surface layer and a clayey and loamy subsoil; formed in old marine deposits

In this map unit, the landscape typically has varied relief. It is dominated by broad, gently sloping ridgetops and short to long, gently sloping to strongly sloping side slopes. The landscape is dissected by a well-defined, branching drainage system. Narrow flood plains border incised, meandering, mostly intermittent streams. Slopes range from 1 to 12 percent. Land use is mainly woodland. Small to large open areas are mainly pasture. A few farm structures are visible. Narrow corridors of open space are maintained as the rights-of-way for utilities. The degree of visual variety is moderate.

This map unit makes up about 22 percent of the parish. It is about 78 percent Sacul soils, 19 percent Keithville soils, and 3 percent soils of minor extent.

The Sacul soils are on gently sloping ridgetops and gently sloping and strongly sloping side slopes. The surface layer is dark brown or dark grayish brown fine sandy loam, and the subsurface layer is brown fine

pasture. Conservation tillage, contour farming, and grassed waterways can minimize soil losses.

These soils are poorly suited to most urban uses. The main limitations are wetness, slow and very slow permeability, and the high shrink-swell potential. Slope is a limitation in some areas.

13. Kisatchie-Oula

Gently sloping to steep, well drained and moderately well drained soils that have a loamy surface layer and a clayey and loamy or clayey subsoil; formed in old marine deposits

In this map unit, the landscape typically has prominent relief. It is part of the uplands and consists of hills and ridges that have narrow, gently sloping tops that break into steep side slopes. Ledges and boulders of sandstone and siltstone bedrock are prominent features. Gullies and other barren or sparsely vegetated areas of severely eroded soils add a rugged appearance to the landscape. Slopes range from 1 to 40 percent. The landscape is deeply incised by a well-defined, branching drainage system. Perennial and intermittent streams are in winding channels on narrow flood plains. Shallow rapids or shoals are common where bedrock forms the positions on ridgetops and upper side slopes. The Betis soils are somewhat excessively drained, and the Briley and Ruston soils are well drained. The Malbis soils are moderately well drained and are on ridgetops, and the Guyton soils are poorly drained and are in narrow drainageways.

The soils in this map unit are mainly used as woodland. Small acreages are used as pasture or homesites.

The soils in this map unit are poorly suited to use as woodland. The potential productivity of loblolly pine is low to moderately high. The main concerns in producing and harvesting timber are the equipment use limitation, high seedling mortality, and low productivity. Steep slopes, rock outcrops, and gullies limit the use of

Of minor extent are the Guyton, Kisatchie, Ruston, and Smithdale soils. The Guyton soils are in narrow drainageways and are poorly drained. The Kisatchie soils are on side slopes at a lower elevation than the Betis and Briley soils, and the Ruston and Smithdale soils are in positions similar to those of the Betis and Briley soils. These soils are well drained.

The soils in this map unit are mainly used as woodland. Small acreages are used for pasture, cultivated crops, or homesites.

The soils in this map unit are moderately well suited to use as woodland. The potential productivity of loblolly pine is high. The sandy texture hinders use of wheeled equipment, especially when the soil is very dry or saturated. Soil droughtiness increases seedling mortality.

sandy loam. The subsoil is strong brown, yellowish brown, and reddish yellow loam and sandy clay loam in the upper part and mottled light gray and red sandy clay loam in the lower part.

The Smithdale soils are well drained and are on strongly sloping and moderately steep side slopes. The surface layer is dark grayish brown fine sandy loam, and the subsurface layer is brown fine sandy loam. The subsoil is red sandy clay loam and sandy loam.

Of minor extent are the Betis, Briley, Guyton, and

The soils in this map unit are well suited to use as woodland. The potential productivity of loblolly pine is high. The soils have few limitations for this use; however, management that minimizes the risk of erosion is needed.

These soils are moderately well suited to cultivated crops and well suited to use as pasture. Slope and the hazard of erosion are limitations in most areas. Conservation tillage, contour farming, and grassed waterways can minimize soil losses from erosion. Lime

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Moreland clay is one of several phases in the Moreland series.

Some map units are made up of two or more major soils. These map units are called soil complexes or soil associations.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Kisatchie-Anacoco complex, 1 to 5 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Guyton-Lotus association, frequently flooded, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

The boundaries of map units in Natchitoches Parish were matched, where possible, with those of the previously completed surveys of Grant, Rapids, and Red River Parishes. In a few places, however, the lines do not join, and there are differences in the names of the map units. These differences result mainly from changes in soil series concepts, differences in map unit design, and changes in soil patterns near survey area boundaries.

The soils in Natchitoches Parish were mapped at the same level of detail, except for areas of frequently flooded bottom lands in the southern part of the parish. Frequent flooding limits the use and management of these soil areas, and separating all of the soils in these areas would be of little importance to the land user.

Ac—Acadia silt loam. This soil is nearly level and somewhat poorly drained. It is on broad, slightly convex ridgetops on uplands. The areas of this soil are irregular in shape and range from 25 to 350 acres. Slopes are generally long and smooth and range from 0 to 2 percent.

Typically, the surface layer is dark grayish brown, very strongly acid silt loam about 6 inches thick. The subsurface layer to a depth of about 8 inches is light yellowish brown, very strongly acid silt loam. The subsoil extends to a depth of about 50 inches. It is yellowish brown clay loam in the upper part, light brownish gray silty clay in the middle part, and light brownish gray clay in the lower part. The subsoil is very strongly acid and is mottled throughout. The substratum to a depth of about 65 inches is light brownish gray, mottled, very strongly acid clay.

Included with this soil in mapping are a few small areas of Gore and Wrightsville soils. Also included are

low areas. Surface crusting is common, and good soil tilth can be somewhat difficult to maintain. Using years. This soil has high shrink-swell potential in the subsoil. Plants are damaged by a lack of water during dry periods in summer and fall of most years.

This soil is mainly used as woodland. Small acreages are used as pasture.

This soil is moderately well suited to use as woodland. It has moderate potential for the production of loblolly pine. Other common trees are longleaf pine, shortleaf pine, and sweetgum. The main concerns in producing and harvesting timber are the moderate equipment use limitation and seedling mortality because of wetness. Conventional methods of harvesting timber generally can be used, but their use can be limited during rainy periods, generally from December to April. Management that minimizes soil compaction should be used. Roads and landings can be protected from erosion by constructing diversions and by seeding cuts and fills.

This soil is moderately well suited to use as habitat for woodland wildlife. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable plants. Prescribed burning every three years, rotated among several small tracts of land, can increase the amount of palatable browse for deer and seed-producing plants for quail and turkey.

This Anacoco soil is moderately well suited to use as pasture. The main limitations are low fertility and

periods because of wetness and very slow permeability. Lagoons or self-contained disposal units can be used to dispose of sewage properly.

This Anacoco soil is in capability subclass IVe. The woodland ordination symbol is 6C.

Ar—Armistead clay. This soil is level and somewhat poorly drained. It is in intermediate positions on natural levees of old distributary channels of the Red River. The areas of this soil are long and narrow and range from 20 to 500 acres. Slopes are generally long and smooth. They are 0 to 1 percent.

Typically, the surface layer is dark reddish brown, slightly acid and neutral clay about 11 inches thick. The next layer to a depth of about 21 inches is very dark gray and dark reddish gray, slightly acid and neutral silty clay loam. The subsoil extends to a depth of about 43 inches. It is reddish brown, mottled, neutral silty clay loam and silt loam in the upper part and reddish brown, moderately alkaline silty clay loam in the lower part. The substratum to a depth of about 60 inches is reddish brown, moderately alkaline clay. In places, the soil is brownish throughout the profile, and in some higher areas, the clay surface layer is less than 10 inches thick.

Included with this soil in mapping are a few small areas of Caspiana, Gallion, Latanier, and Moreland soils. The Caspiana and Gallion soils are in slightly higher needed to remove excess surface water. Land grading and smoothing improve surface drainage and permit more efficient use of farm equipment. Fertilizers are generally not needed for the production of legume crops. Nonlegume crops require nitrogen fertilizer. Lime is generally not needed.

This Armistead soil is well suited to use as pasture. The main limitations are wetness and the clay surface texture. Suitable pasture plants are common bermudagrass, improved bermudagrass, dallisgrass, tall fescue, white clover, vetch, and winter peas. Annual cool-season grasses, such as ryegrass and wheat, are

Typically, the surface layer is very dark gray, medium acid silt loam about 5 inches thick. The subsurface layer to a depth of about 10 inches is dark grayish brown, strongly acid silt loam. The subsoil extends to a depth of about 60 inches. It is yellowish brown, mottled, strongly acid silt loam in the upper part; light brownish gray, mottled, strongly acid silty clay loam in the middle part; and light gray, mottled, strongly acid silty clay loam in the lower part. Red nodules of plinthite are common in the middle and lower parts of the subsoil. In places, the surface layer is fine sandy loam.

Included with this soil in mapping are a few small such as ryegrass or wheat, are suitable for winter forage. Grazing when the soil is wet results in puddling of the surface layer. Drainage is needed in low places. Lime and fertilizer can overcome the low fertility and promote good growth of forage plants. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and the soil in good condition.

This soil is well suited to most cultivated crops. The main soil limitations are wetness, low fertility, and the hazard of erosion. Suitable crops are corn, grain sorghum, wheat, cotton, and soybeans. This soil is friable and easy to keep in good tilth. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry. Wetness can delay planting in some areas. Drainage is needed in low areas. Crop residue on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Runoff and erosion can be reduced by fertilizing and seeding a cover crop in the fall. Tillage should be on the contour or across the slope. Most crops respond well to lime and fertilizer, which help to overcome the low fertility and reduce the high levels of exchangeable aluminum in the root zone.

This soil is moderately well suited to urban uses. It has moderate limitations for building sites and local roads and streets and severe limitations for most sanitary

a special symbol on the soil maps. Keithville and Ruston soils are in slightly higher positions than the Bellwood soil and are loamy in the upper part of the subsoil. The Natchitoches soils are well drained, and the Sacul soils are moderately well drained. These soils are in positions similar to those of the Bellwood soil and do not have intersecting slickensides in the subsoil. The included soils make up about 20 percent of the map unit.

This Bellwood soil has low fertility and high levels of exchangeable aluminum that are potentially toxic to most crops. Water runs off the surface at a medium rate, and water and air move through this soil very slowly. A seasonal high water table is about 2 to 4 feet below the soil surface from December to April. The soil has high shrink-swell potential in the subsoil. Plants generally are damaged by a lack of water during dry periods in summer and fall of most years.

This soil is mainly used as woodland. Small acreages are used as pasture or homesites.

This soil is moderately well suited to use as woodland. The site index for loblolly pine is about 78. Common trees are loblolly pine, shortleaf pine, white oak, and southern red oak. The main concerns in producing and harvesting timber are a severe equipment use limitation because of the clayey surface layer and a moderate erosion hazard because of the slope and slow water grazing during wet periods help keep the pasture and the soil in good condition.

This soil is somewhat poorly suited to cultivated crops. It is limited mainly by low fertility, poor tilth, and a severe erosion hazard. Close-sown crops, such as small grains, are the most suitable to plant, but soybeans and grain sorghum are suitable crops if soil conserving practices are used. Early fall seeding, conservation tillage, terraces, diversions, and grassed waterways help control erosion. All tillage should be on the contour or across the slope. Most crops respond well to lime and fertilizer, which help to overcome the low fertility and reduce the high levels of exchangeable aluminum in the root zone.

This soil is poorly suited to use as homesites. It has severe limitations for building sites, local roads and streets, and most sanitary facilities because of very slow permeability, wetness, and high shrink-swell potential. In addition, low strength is a severe limitation for roads. If buildings are constructed on this soil, structural damage as a result of shrinking and swelling of the soil can be prevented by properly designing foundations and footings and by diverting runoff from buildings. Septic tank absorption fields do not function properly during rainy periods because of wetness and very slow permeability. Lagoons or self-contained sewage disposal units can be used to dispose of sewage properly. Roads and streets should be designed to overcome the limited load-supporting capacity of the subsoil.

This Bellwood soil is in capability subclass IVe. The woodland ordination symbol is 8C.

Bd—Bellwood clay, 5 to 12 percent slopes. This soil is strongly sloping and somewhat poorly drained. It is on side slopes on the uplands. Well-defined drainageways cross most areas. The areas of this soil are irregular in shape and range from 20 to 500 acres. Slopes are generally short and complex.

Typically, the surface layer is brown, very strongly acid very fine sandy loam about 2 inches thick. The subsoil to a depth of about 60 inches is red, extremely acid clay in the upper part and light brownish gray, mottled, extremely acid clay in the lower part. In places, the surface layer is silty clay loam, fine sandy loam, or silt loam, and it can be as much as 10 inches thick.

Included with this soil in mapping are a few small areas of Guyton, Keithville, Natchitoches, and Sacul soils. Also included are small areas of soils similar to the Bellwood soil except that they are calcareous to the surface. These areas of calcareous soils are identified by a special symbol on the soil map. The Guyton soils are poorly drained and are grayish and loamy throughout the

not have intersecting slickensides in the subsoil. The included soils make up about 20 percent of the map unit.

This Bellwood soil has low fertility and high levels of exchangeable aluminum that are potentially toxic to most crops. Water runs off the surface at a rapid rate, and water and air move through this soil very slowly. A seasonal high water table is about 2 to 4 feet below the soil surface from December to April. This soil has high shrink-swell potential in the subsoil. Plants generally are damaged by a lack of water during dry periods in summer and fall of most years.

This soil is used mainly as woodland. Small acreages are used as pasture or homesites.

This soil is moderately well suited to use as woodland. The site index for loblolly pine is about 78. Common trees are loblolly pine, shortleaf pine, white oak, and southern red oak. The main concerns in producing and harvesting timber are a severe equipment use limitation because of the clayey surface layer and a moderate erosion hazard because of the slope. Management that minimizes the risk of erosion is essential in harvesting timber. Harvesting during dry seasons and locating skid trails, log landings, and haul roads properly and within limiting grades can reduce erosion. Roads and landings can be protected from erosion by constructing diversions and by seeding cuts and fills. Conventional methods of harvesting timber generally can be used, but their use may be limited during rainy periods, generally from December to April. Logging roads require suitable surfacing for year-round use. Reforestation, after harvesting, must be carefully managed to reduce competition from undesirable understory plants. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees.

This soil is well suited to use as habitat for woodland wildlife. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable plants. Prescribed burning every three years, rotated among several small tracts of land, can increase the amount of palatable browse for deer and seed-producing plants for quail and turkey.

This Bellwood soil is somewhat poorly suited to use as pasture. The main limitations are low fertility and a severe erosion hazard during the establishment of pasture grasses. Suitable pasture plants are common bermudagrass, Pensacola bahiagrass, and crimson clover. Annual cool-season grasses, such as ryegrass or wheat, are suitable for winter forage. Fertilizer and lime are needed for optimum growth of grasses and legumes. Seedbed preparation should be on the contour or across fertility, and short, irregular slopes. Close-sown crops, such as small grains, are suitable. The irregular slopes and drainageways limit the use of equipment. Conservation tillage, terraces, diversions, and grassed

especially when the soil is saturated or very dry. The low available water capacity generally reduces seedling survival, especially in areas where understory plants are numerous. Proper site preparation controls initial plant

Typically, the surface layer is dark grayish brown, very

This soil is poorly suited to most cultivated crops. It is

This soil is well suited to use as woodland. It has high production potential for loblolly pine. The site index for loblolly pine is about 96. Other common trees are shortleaf pine, longleaf pine, white oak, water oak, and southern red oak. The main concerns in producing and harvesting timber are a moderate equipment use limitation and seedling mortality because of the sandy texture and soil droughtiness. The sandy surface layer hinders use of wheeled equipment, especially when the soil is saturated or very dry. The low available water capacity of the soil generally reduces seedling survival, especially in areas where understory plants are numerous. Proper site preparation controls initial plant competition, and spraying controls subsequent growth.

This soil is moderately well suited to use as habitat for woodland wildlife. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable plants. Prescribed burning every three years, rotated among several small tracts of land, can increase the amount of palatable browse for deer and seed-producing plants for quail and turkey.

This Bienville soil is moderately well suited to use as pasture. The main limitations are low fertility and droughtiness. Suitable pasture plants are improved bermudagrass, Pensacola bahiagrass, weeping lovegrass, and crimson clover. Fertilizer and lime are needed for optimum growth of grasses and legumes. Proper stocking and pasture rotation help keep the pasture in good condition.

This soil is moderately well suited to most cultivated crops. It is limited mainly by low fertility and droughtiness, and erosion is a hazard in the more sloping areas. Suitable crops are corn, grain sorghum, wheat, peanuts, watermelons, and soybeans. This soil is friable and easy to keep in good tilth. It can be worked throughout a wide range of moisture content. Crop residue on or near the surface helps to conserve moisture, maintain tilth, and control erosion. All tillage should be on the contour or across the slope. Most crops respond well to lime and fertilizer, which help to overcome the low fertility and reduce the levels of exchangeable aluminum in the root zone.

This soil is moderately well suited to urban uses. It has slight limitations for building sites and local roads and streets and moderate to severe limitations for most sanitary facilities. The main limitations are moderately rapid permeability and the sandy texture. During the rainy season, effluent from onsite sewage disposal systems may seep at points downslope. Lined sewage lagoons or community sewage systems may be needed to prevent contamination of water supplies as a result of seepage. Where shallow excavations are constructed, the cutbanks cave easily. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Plants that tolerate droughtiness should be selected if irrigation is not provided.

This Bienville soil is in capability subclass IIIs. The woodland ordination symbol is 10S.

Br—Briley loamy fine sand, 1 to 5 percent slopes. This soil is gently sloping and well drained. It is on convex ridgetops on the uplands. The areas of this soil are irregular in shape and range from 15 to 200 acres.

Typically, the surface layer is dark grayish brown, strongly acid loamy fine sand about 8 inches thick. The subsurface layer is light yellowish brown, strongly acid loamy fine sand to a depth of about 20 inches. The subsoil to a depth of about 60 inches is yellowish red, medium acid fine sandy loam in the upper part and red, strongly acid sandy clay loam in the lower part.

Included with this soil in mapping are a few small areas of Betis, Kisatchie, and Ruston soils. The Betis and Ruston soils are in positions similar to those of the Briley soil. The Betis soils are sandy throughout the profile, and the Ruston soils are loamy throughout. The Kisatchie soils are on ridgetops and side slopes at a lower elevation than the Briley soil, and they have a clayey subsoil. The included soils make up about 20 percent of the map unit.

This Briley soil has low fertility. Water runs off the surface slowly, and water and air move through this soil at a moderate rate. This soil dries out quickly and is droughty. The shrink-swell potential is low. Plants generally are damaged by a lack of water during dry periods in summer and fall of most years.

This soil is mainly used as woodland. Small acreages are used as cropland, pasture, or homesites.

This soil is well suited to use as woodland. The site index for loblolly pine is about 80. Other common trees are shortleaf pine, longleaf pine, hickory, white oak, and southern red oak. The main concerns in producing and harvesting timber are a moderate equipment use limitation because of the sandy soil texture and moderate seedling mortality because of soil droughtiness. The sandy texture of the surface layer hinders use of wheeled equipment, especially when the soil is saturated or very dry. The low available water capacity generally reduces seedling survival, especially in areas where understory plants are numerous. Proper site preparation can control initial plant competition, and spraying will control subsequent growth. Roads and landings can be protected from erosion by constructing diversions and by seeding cuts and fills.

This soil is well suited to use as habitat for woodland wildlife. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging propagation of desirable plants. Prescribed burning every three years, rotated among several small tracts of land, can increase the amount of palatable browse for deer and seed-producing plants for quail and turkey.

This Briley soil is moderately well suited to use as pasture. The main limitations are low fertility and soil droughtiness. Suitable pasture plants are improved bermudagrass, Pensacola bahiagrass, weeping lovegrass, and crimson clover. Fertilizer and lime are needed for optimum growth of grasses and legumes. Proper stocking and pasture rotation help keep the pasture in good condition.

This soil is moderately well suited to most cultivated crops. It is limited mainly by low fertility and soil

The Kisatchie soils are on side slopes at a lower elevation than the Briley soil, and they have a clayey subsoil. The included soils make up about 20 percent of the map unit.

This Briley soil has low fertility. Water and air move through this soil at a moderate rate, and water runs off the surface slowly. This soil dries out quickly and is droughty. The shrink-swell potential is low. Plants and should be on the contour or across the slope. Crop residue on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Most crops respond well to lime and fertilizer.

This soil is moderately well suited to urban development. It has moderate limitations for buildings and local roads and streets, and moderate to severe limitations for most sanitary facilities. The main

This soil is mainly used as woodland. Small acreages are used as pasture.

This soil is moderately well suited to use as woodland. It has moderately high production potential for loblolly pine. The site index for loblolly pine is about 80. Other common trees are shortleaf pine, longleaf pine, hickory, white oak, and southern red oak. The main concerns in producing and harvesting timber are moderately steep can tolerate droughtiness should be selected if irrigation is not provided.

This Briley soil is in capability subclass VIe. The woodland ordination symbol is 8S.

Ca—Caddo very fine sandy loam. This soil is level and poorly drained. It is on broad flats on the uplands. The areas of this soil are broad and range from 25 to 350 acres. Slopes are less than 1 percent.

Typically, the surface layer is grayish brown, strongly acid very fine sandy loam about 4 inches thick. The subsurface layer is light brownish gray, mottled, strongly acid very fine sandy loam to a depth of about 26 inches. The subsoil to a depth of about 60 inches is gray, mottled, medium acid and strongly acid silty clay loam.

Included with this soil in mapping are a few small areas of Beauregard, Guyton, and Malbis soils. Also included are small areas of moderately well drained, loamy soils on low, rounded mounds. Beauregard and Malbis soils are in higher, more convex positions than the Caddo soil and contain more than 5 percent plinthite in the subsoil. Guyton soils are in slightly concave positions and do not have red mottles or plinthite in the subsoil. The included soils make up about 20 percent of the map unit.

This Caddo soil has low fertility and high levels of exchangeable aluminum that are potentially toxic to most crops. Water runs off the surface slowly and stands in low places for short periods after heavy rains. Water and air move through this soil slowly. The soil remains wet for long periods during the winter and spring. A seasonal high water table is within 2 feet of the soil surface from December to April in most years. The shrink-swell

burning every three years, rotated among several small tracts of land, can increase the amount of palatable browse for deer and seed-producing plants for quail and turkey.

This Caddo soil is well suited to use as pasture. The main limitations are low fertility and wetness. Suitable pasture plants are common bermudagrass, Pensacola bahiagrass, white clover, vetch, and winter peas. Annual cool-season grasses, such as ryegrass and wheat, are suitable for winter forage. Grazing when the soil is wet results in puddling of the soil surface layer. Excessive water on the surface can be removed by shallow ditches. Lime and fertilizer can overcome the low fertility and promote good growth of forage plants. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and the soil in good condition.

This soil is moderately well suited to most cultivated crops. It is limited mainly by low fertility and wetness. Droughtiness late in summer is an additional problem. Suitable crops are grain sorghum, rice, corn, and soybeans. A surface crust may form in areas that are clean tilled. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. A drainage system is needed for most cultivated crops and pasture plants. Most crops respond well to lime and fertilizer, which help to overcome the low fertility and reduce the level of exchangeable aluminum in the root zone.

This soil is poorly suited to urban uses. It has severe limitations for building sites, local roads and streets, and depths of 50 and 60 inches is gravelly sand or gravelly sandy loam.

Grain sorghum and wheat are also suitable crops. This soil is friable and easy to keep in good tilth. It can be on or near the surface reduces runoff and helps to maintain soil tilth and organic matter content. Most crops respond well to fertilizer. Lime is generally not needed.

This soil is well suited to use as pasture and has few limitations for this use. Suitable pasture plants are common bermudagrass, improved bermudagrass, Pensacola bahiagrass, tall fescue, and white clover. Annual cool-season grasses, such as ryegrass and wheat, are suitable for winter forage. Shallow ditches can be used to drain low areas. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and the soil in good condition. Nitrogen fertilizer is needed for maximum forage production. Lime and other fertilizers are generally not needed.

yellowish red and strong brown, slightly acid and neutral very fine sandy loam. In places, the surface layer is calcareous.

Included with this soil in mapping are a few small areas of Armistead, Caspiana, and Latanier soils. Also included are small areas of Gallion soils that have a silty clay loam surface layer and Gallion soils that have slopes of more than 1 percent. Armistead and Latanier soils are in lower positions than the Gallion soil and are clayey in the upper part of the profile. Caspiana soils are in slightly lower positions and have a dark color surface layer. The included soils make up about 15 percent of the map unit.

Figure 1.—Gallion silt loam is used mainly for cultivated crops. The soil in the background is Bellwood clay, 5 to 12 percent slopes. It is used as pasture.

lines, ditchbanks, and abandoned building sites provide excellent cover and nesting areas for birds and small animals if the vegetation in these areas is allowed to

This Gallion soil is in capability class I. The woodland ordination symbol is 9A.

other areas, the surface layer and upper part of the subsoil are calcareous.

Included with this soil in mapping are a few small areas of Armistead, Caspiana, and Latanier soils. Also included are a few small areas of Gallion silt loam. The Armistead and Latanier soils are in slightly lower

animals if the vegetation in these areas is allowed to grow naturally.

This soil is moderately well suited to urban uses. It has moderate limitations for building sites and most sanitary facilities because of moderate permeability and moderate shrink-swell potential. Low strength is a limitation for shortleaf pine, sweetgum, white oak, post oak, and southern red oak. The site index for loblolly pine is about 76. The main concern in producing and harvesting timber is the moderate equipment use limitation caused by the clayey subsoil. Because the subsoil is sticky when wet, most planting and harvesting equipment should be used only during dry periods. Using low pressure ground equipment during rainy periods reduces rutting and compaction of the soil and helps to maintain productivity. Roads and landings can be protected from erosion by constructing diversions and by seeding cuts and fills. Reforestation, after harvesting, must be carefully managed to reduce competition from undesirable understory plants. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees.

The soil is moderately well suited to use as habitat for woodland wildlife. Habitat can be improved by planting

This Gore soil is in capability subclass IVe. The woodland ordination symbol is 7C.

Gt—Guyton silt loam. This soil is level and poorly drained. It is on broad flats on low stream terraces. The areas of this soil are broad and range from 30 to 350 acres. Slopes are less than 1 percent.

Typically, the surface layer is dark grayish brown, very strongly acid silt loam about 6 inches thick. The subsurface layer is light brownish gray, mottled, strongly acid silt loam to a depth of about 18 inches. The subsoil to a depth of about 60 inches is light brownish gray, mottled, very strongly acid silt loam in the upper part; gray, mottled, strongly acid silty clay loam in the middle part; and grayish brown, mottled, very strongly acid silty clay loam in the lower part.

Included with this soil in mapping are a few small areas of Beauregard, Caddo, and Cahaba soils. Also included are small areas of moderately well drained understory plants. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees.

This soil is moderately well suited to use as habitat for woodland wildlife and well suited as habitat for wetland wildlife. Habitat for wetland wildlife can be improved by constructing shallow ponds to provide open water areas for waterfowl and furbearing animals, such as muskrat, nutria, and otter. Habitat for other wildlife can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable plants.

This Guyton soil is well suited to use as pasture; however, wetness and low fertility are limitations. Suitable pasture plants are common bermudagrass, Pensacola bahiagrass, white clover, vetch, and winter peas. Surface drainage can remove excess surface water from low areas. Wetness limits the choice of plants and the period of grazing. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and the soil in good condition. Lime and fertilizer can improve soil fertility and promote good growth of forage plants.

The soil is moderately well suited to cultivated crops. It is limited mainly by low fertility, wetness in spring, and droughtiness in summer. Suitable crops are grain sorghum, corn, rice, and soybeans. A drainage system is needed for most cultivated crops. A surface crust forms easily after tillage. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Most crops respond well to lime and fertilizer, which help to overcome the low fertility and reduce the levels of exchangeable aluminum in the root zone. Where water of suitable quality is available, supplemental irrigation can prevent damage to crops that results during dry periods of most years.

This soil is poorly suited to urban development. It has severe limitations for building sites, local roads and streets, and most sanitary facilities because of wetness and the hazard of flooding. Drainage is needed if roads and building foundations are constructed. Buildings can be placed on pilings or mounds to elevate them above the expected flood level. Slow permeability and the high water table increase the possibility of failure of septic tank absorption fields. Properly designed lagoons or self-contained sewage disposal units can be used to dispose of sewage properly.

This Guyton soil is in capability subclass IIIw. The woodland ordination symbol is 9W.

Gy—Guyton silt loam, frequently flooded. This soil is level and poorly drained. It is on flood plains of streams that drain the uplands. It is subject to frequent flooding. The areas of this soil are long and narrow and range from 10 to 1,000 acres. Slopes are less than 1 percent.

Typically, the surface layer is dark grayish brown, very strongly acid silt loam about 4 inches thick. The subsurface layer is grayish brown and light brownish gray, mottled, very strongly acid silt loam to a depth of about 19 inches. The subsoil to a depth of about 60 inches is gray, mottled, very strongly acid silty clay loam in the upper part; grayish brown, mottled, very strongly acid silty clay loam in the middle part; and light brownish gray, mottled, very strongly acid clay loam in the lower part. In places, the surface layer is fine sandy loam.

Included with this soil in mapping are a few small areas of Bienville, Cahaba, and Lotus soils. Also included are moderately well drained, loamy soils on natural levees of streams. The Bienville and Cahaba soils are on low terraces adjacent to and within the flood plain. Bienville soils are somewhat excessively drained, and Cahaba soils are well drained. The Lotus soils are on natural levees adjacent to stream channels and are sandy throughout the profile. The included soils make up about 20 percent of the map unit.

This Guyton soil has low fertility and moderately high levels of exchangeable aluminum that are potentially toxic to some crops. Water and air move through this soil at a slow rate, and water runs off the surface slowly. A seasonal high water table is within 1.5 feet of the soil surface from December to May in most years. This soil is flooded for very brief to long periods. Flooding occurs more often than twice in 5 years during anytime of the year. Floodwaters typically are 2 to 5 feet deep, but the depth exceeds 10 feet in places. The shrink-swell potential is low. Plants are damaged by a lack of water during dry periods in summer and fall of some years.

This soil is mainly used as woodland. In a few areas, it is used as pasture or cropland.

This soil is moderately well suited to use as woodland. Common trees in areas of this soil are loblolly pine, shortleaf pine, water oak, sweetgum, willow oak, and swamp chestnut oak. The potential production of loblolly pine is high. The main concerns in producing and harvesting timber are a severe equipment use limitation and high seedling mortality because of wetness and frequent flooding. Trafficability is poor when the soil is wet. Using low-pressure ground equipment or harvesting during drier periods reduces rutting and soil compaction and helps to maintain productivity. Seedling mortality can be reduced by providing drainage or by planting seedlings on bedded rows. Trees should be water-tolerant, and they should be planted or harvested during dry periods. Reforestation, after harvesting, must be carefully managed to reduce competition from undesirable understory plants.

This soil is moderately well suited to use as habitat for woodland wildlife and well suited as habitat for wetland wildlife. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable plants. Habitat for wetland wildlife can be improved by constructing shallow ponds to provide open water areas for waterfowl and furbearing animals, such as muskrat, nutria, and otter.

This Guyton soil is poorly suited to use as pasture because of frequent flooding, low fertility, and wetness. The main suitable pasture plant is common bermudagrass. Frequent flooding and wetness limit the choice of pasture plants and the period of grazing. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and the soil in good condition. It is generally not practical to apply high rates of fertilizer or lime because of the hazard of frequent overflow.

This soil is poorly suited to cultivated crops because of low fertility, wetness, and frequent flooding. Planting dates are delayed and crops are damaged by floods in most years. If this soil is protected from flooding and if drainage is provided, most climatically adapted crops can be grown.

This soil is poorly suited to most urban uses and is generally not suited to use as homesites. The soil has severe limitations for building sites, local roads and streets, and most sanitary facilities because of frequent flooding and wetness. Ring levees, pumps, and other water control systems can control flooding and remove excess water. Buildings can be placed on pilings or mounds to elevate them above the expected flood level.

This Guyton soil is in capability subclass Vw. The woodland ordination symbol is 9W.

GZ—Guyton-Lotus association, frequently flooded. The Guyton and Lotus soils are on flood plains of streams that drain the uplands. Guyton soils are poorly drained, and the Lotus soils are moderately well drained to somewhat poorly drained. These soils are subject to frequent flooding. This map unit is entirely in one long and narrow delineation of several thousand acres. It is crossed by several perennial streams and many

feet deep, but the depth can exceed 10 feet in places. Flooding is generally by fast-flowing water and lasts from a few hours to several days. It occurs more often than twice in 5 years and at anytime during the year.

Typically, the Guyton soil has a dark grayish brown, strongly acid silt loam surface layer about 4 inches thick. The subsurface layer is light brownish gray, mottled, very strongly acid silt loam about 14 inches thick. The subsoil to a depth of about 60 inches is gray, mottled, very strongly acid silty clay loam in the upper and middle parts and grayish brown, mottled, very strongly acid silty clay loam in the lower part. Tongues of light brownish gray silt loam extend through the upper part of the subsoil. In places, the surface layer is fine sandy loam or loamy fine sand.

This Guyton soil has low fertility and moderately high levels of exchangeable aluminum that are potentially toxic to some crops. Water and air move through this soil slowly. Water runs off the surface at a slow rate and stands in low areas for long periods after heavy rains. A seasonal high water table is within 1.5 feet of the soil surface from December to May in most years. The shrink-swell potential is low. Plants are damaged by a lack of water during dry periods in summer and fall of some years.

Typically, the Lotus soil has a grayish brown, slightly acid sand surface layer about 2 inches thick. The next layer is light brownish gray, medium acid sand to a depth of about 10 inches. Below that to a depth of about 65 inches are buried soil horizons of grayish brown, strongly acid sand; light brownish gray, mottled, strongly acid loamy sand; and light gray, mottled, very strongly acid loamy sand.

The Lotus soil has low fertility. Water and air move through this soil at a rapid rate, and water runs off the surface slowly. A seasonal high water table is 1.5 to 3 feet below the soil surface from December to April. The soil dries quickly after rains. The shrink-swell potential is low. Plants generally are damaged by a lack of water during dry periods in summer and fall of most years.

mortality because of wetness and frequent flooding. Conventional methods of harvesting timber generally can be used, but their use may be limited during rainy periods, generally from December through April. Standard-wheeled and tracked vehicles cause rutting and soil compaction, especially in areas of the Guyton soil. Using low-pressure ground equipment reduces damage to the soil and helps to maintain productivity. Trafficability is poor on the Lotus soil when it is saturated or very dry. Logging roads require suitable surfacing for year-round use. Tree seedlings have a low rate of survival because of frequent flooding and wetness in spring and soil droughtiness in summer. Seedling survival can be improved on the Guyton soil by planting on bedded rows. Reforestation, after harvesting, must be carefully managed to reduce competition from undesirable understory plants. Site preparation, such as chopping, burning, herbicide application, and bedding, should reduce debris and immediate plant competition and facilitate mechanical planting.

These soils are moderately well suited to use as habitat for woodland wildlife. The Guyton soil is well suited to use as habitat for wetland wildlife, and the Lotus soil is poorly suited. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable plants. Habitat for wetland wildlife can be improved by constructing shallow ponds in the Guyton soil to provide open water areas for waterfowl and furbearing animals, such as muskrat, nutria, and otter.

The Guyton and Lotus soils are poorly suited to use as pasture because of frequent flooding, low fertility, wetness in spring, and droughtiness in summer. The

broad ridgetops on uplands. The areas of this soil are broad and range from 15 to 650 acres. Slopes are long, smooth, and slightly convex.

Typically, the surface layer is dark brown, very strongly acid loam about 7 inches thick. The subsoil to a depth of about 60 inches is brown, mottled, very strongly acid loam and clay loam in the upper part; brownish yellow, mottled, strongly acid clay loam in the middle part; and red and light brownish gray, mottled, very strongly acid clay and clay loam in the lower part.

Included with this soil in mapping are a few small areas of Bellwood, Malbis, and Sacul soils. Also included are small areas of Keithville soils that have slopes of more than 5 percent. Bellwood and Sacul soils are on slopes at a lower elevation than that of the Keithville soil and do not have a subsoil that is loamy in the upper part. Malbis soils are in slightly higher positions and are loamy throughout the profile. The included soils make up about 20 percent of the map unit.

This Keithville soil has low fertility and high levels of exchangeable aluminum that are potentially toxic to most crops. Water and air move through this soil very slowly, and water runs off the surface at a medium rate. A seasonal high water table is about 2 to 3 feet below the soil surface from December to April. The soil has high shrink-swell potential in the lower part of the subsoil. Plants are damaged by a lack of water during dry periods in summer and fall of some years.

This soil is mainly used as woodland. Small acreages are used as pasture, cropland, or homesites.

This soil is well suited to use as woodland. The production potential for loblolly pine and shortleaf pine is high. The site index for loblolly pine is about 90.

Figure 2.—Deep ruts are made if trees on Keithville loam, 1 to 5 percent slopes, are logged when the soil is wet. Rutting and soil compaction are major concerns in many soils in Natchitoches Parish.

grasses, such as ryegrass and wheat, are suitable for winter forage. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking, pasture rotation, and restricted grazing during

easily, but these can be broken up by deep plowing or chiseling. Crop residue on the soil surface, contour farming, grassed waterways, and terraces help control runoff and erosion. Most crops respond well to lime and properly during rainy periods because of wetness and very slow permeability. Lagoons or self-contained sewage disposal systems can be used to dispose of sewage properly. A seasonal high water table is perched above the clayey subsoil, and drainage should be provided if buildings are constructed. Roads and streets should be designed to compensate for the moderate load-supporting capacity and instability of the subsoil.

This Keithville soil is in capability subclass IIIe. The woodland ordination symbol is 9W.

Kt—Kisatchie clay, 1 to 15 percent slopes, severely eroded. This soil is gently sloping to moderately steep and well drained. It is on ridgetops and side slopes on the uplands. The areas are severely eroded, crossed by many deep gullies, and contain many small outcroppings of siltstone or sandstone (fig. 3). Vegetation is sparse throughout most areas. The areas of this soil are irregular in shape and range from 5 to 150 acres. Slopes are generally short and complex.

Typically, the upper inch of this soil is very dark grayish brown, very strongly acid silty clay loam. The subsoil is pale olive, very strongly acid clay to a depth of about 35 inches. The substratum to a depth of about 60 inches is olive siltstone. In some places, the surface layer is fine sandy loam, silt loam, or clay. In other places, the surface and subsurface layers have been eroded away and the subsoil is exposed at the surface.

Figure 3.—Kisatchie clay, 1 to 15 percent slopes, severely eroded, produces little vegetation and is poorly suited to most uses.

The surface layer of this soil is considered to be clay because the silty clay loam is too thin to significantly

and Pensacola bahiagrass can be grown. Lime and fertilizer can encourage faster growth. Diversions and sandy loam. The subsoil extends to a depth of about 43 inches. It is grayish brown and strong brown, mottled, very strongly acid clay in the upper part; grayish brown, mottled, very strongly acid clay in the middle part; and light brownish gray, mottled, very strongly acid silty clay in the lower part. The substratum is light olive brown stratified silty clay loam and loam to a depth of about 60 inches. In some places, the surface layer is silt loam or fine sandy loam. In other places, the substratum between depths of 40 and 60 inches is siltstone or sandstone bedrock.

The Anacoco soil has low fertility and moderately high levels of exchangeable aluminum that are potentially toxic to some crops. Water and air move through this soil very slowly, and water runs off the surface at a medium rate. A seasonal high water table is within 1 foot of the soil surface from December to April in most years. This soil has high shrink-swell potential. Plants are damaged by lack of water during dry periods in summer and fall of most years.

Included with this complex in mapping are a few small areas of Betis, Briley, and Oula soils and outcroppings of sandstone and siltstone bedrock. Soils similar to the Anacoco soil except that they have a calcareous subsoil and soils that are loamy throughout and are shallow to moderately deep to siltstone are also included. Betis and Briley soils are in high positions on ridgetops and have thick sandy surface and subsurface layers. The Oula soils are in positions similar to those of the Kisatchie soil. They are moderately well drained and do not have bedrock within 40 inches of the soil surface. Outcroppings of bedrock are scattered throughout the area but typically are on ridgetops and the shoulders of slopes.

The Kisatchie and Anacoco soils are mainly used as woodland. In a few areas, these soils are used as homesites or pasture.

The soils in this complex are poorly suited to use as woodland. The production potential for loblolly pine is moderately low. The main concerns in producing and harvesting timber are a moderate equipment use limitation and moderate seedling mortality. Soil erosion is also a hazard during and after harvesting operations. The seedling mortality rate is higher in summer because of a shortage of moisture during this period. Hand planting hardy nursery stock can increase seedling survival. Conventional methods of harvesting timber generally can be used but their use can be limited during rainy periods, generally from December to April. Logging roads require suitable surfacing for year-round use. Rock outcrops and boulders also limit the use of equipment. Mechanical planting of trees on the contour helps to control erosion. Roads and landings can be protected from erosion by constructing diversions and by seeding cuts and fills. Adequate water bars on skid trails and firebreaks also help to control soil loss.

These soils are moderately well suited to use as habitat for woodland wildlife. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable plants. Prescribed burning every three years, rotated among several small tracts of land, can increase the amount of palatable browse for deer and seed-producing plants for quail and turkey.

The Kisatchie and Anacoco soils are somewhat poorly suited to use as pasture because of low fertility and droughtiness. Wetness is an additional limitation to use of the Anacoco soil. In places, rock outcrops limit the use of equipment. The main suitable pasture grasses are common bermudagrass, Pensacola bahiagrass, ball clover, and crimson clover. Adding lime and fertilizer to the soil can overcome the low fertility and increase forage production.

These soils are somewhat poorly suited to cultivated crops because of steepness of slope, low fertility, and a severe hazard of erosion. In places, stoniness limits the use of equipment. The main suitable crops are soybeans and grain sorghum. Using conservation tillage and returning all crop residue to the soil or regularly adding other organic matter improve fertility and help to maintain soil tilth and content of organic matter. Early fall seeding, conservation tillage, terraces, diversions, and grassed waterways help control erosion. Most crops respond well to lime and fertilizer, which help to overcome the low fertility and reduce the levels of exchangeable aluminum in the root zone.

These soils are poorly suited to urban development. They have severe limitations for building sites, local roads and streets, and most sanitary facilities because of very slow permeability, high shrink-swell potential, and low strength. Wetness of the Anacoco soil and moderate depth to bedrock in the Kisatchie soil are additional limitations. Septic tank absorption fields do not function properly during rainy periods because of wetness and very slow permeability. In areas of the Anacoco soil, lagoons or self-contained disposal units can be used to dispose of sewage properly. Roads should be designed to overcome the low load-supporting capacity of the soils. If buildings are constructed on these soils, structural damage as a result of shrinkage and swelling can be prevented by properly designing foundations and footings and by diverting runoff from buildings.

This complex is in capability subclass IVe. The woodland ordination symbol is 6D for the Kisatchie soil and 7C for the Anacoco soil.

Kz—Kisatchie-Oula fine sandy loams, 5 to 40 percent slopes. These soils are on strongly sloping to steep side slopes on the uplands. Areas of the Kisatchie soil are too intricately intermingled with areas of the Oula soil to be mapped separately at the selected scale. The Kisatchie soil is well drained and is on convex slopes. The Oula soil is moderately well drained and is on plane slopes. The areas of these soils are irregular in shape and range from 10 to 350 acres. They are about 40 percent Kisatchie soil and 40 percent Oula soil. Slopes are typically short and complex, but some are long and smooth. Well-defined drainageways and gullies cross most areas of these soils.

and difficulty in establishing seedlings because of steep slopes and the clayey subsoil. Soil erosion is also a hazard during and after harvesting operations. The seedling mortality rate is moderate because of a moisture shortage in the Kisatchie soil. Hand planting hardy nursery stock can increase seedling survival.

Figure 4.—Cobbles and boulders of sandstone or siltstone restrict the use of equipment in woodland areas of Kisatchie-Oula fine sandy loams, 5 to 40 percent slopes.

backfilling with material that has low shrink-swell potential.

The Kisatchie and Oula soils are in capability subclass VIe. The woodland ordination symbol is 6D for the Kisatchie soil and 8C for the Oula soil.

La—Latanier clay. This soil is level and somewhat poorly drained. It is in intermediate positions on natural levees on the Red River alluvial plain. The areas of this soil are long and narrow and range from 20 to several hundred acres. Slopes are long and smooth and are 0 to 1 percent.

Typically, the surface layer is dark brown, neutral clay about 6 inches thick. The upper part of the subsoil is dark reddish brown, neutral clay, and the lower part is reddish brown, neutral clay. The substratum to a depth of about 60 inches is yellowish red, neutral and mildly alkaline silt loam.

Included with this soil in mapping are a few small areas of Armistead, Gallion, Moreland, and Roxana soils. Also included are small areas of Latanier soils that have gently undulating slopes. The Armistead soils are on the natural levees of former channels and distributaries of the Red River. They are clayey to a depth of less than 20 inches and loamy below that. Gallion and Roxana soils are in higher positions than the Latanier soil and are loamy throughout the profile. Moreland soils are in lower positions and are clayey throughout. The included

limitations and seedling mortality because of soil wetness and the clayey surface layer. Trees suitable for planting include eastern cottonwood and American sycamore.

This soil is well suited to use as habitat for woodland and openland wildlife. Habitat for whitetail deer, squirrels, and many species of nongame birds and animals can be

Figure 5.—This well-managed area of loblolly pine is on Malbis fine sandy loam, 1 to 5 percent slopes.

This soil is moderately well suited to most cultivated crops. The level slopes and high fertility are favorable features for cultivated crops. The main limitation is wetness, which can delay planting and harvesting in some years. Suitable crops are soybeans, cotton, rice, wheat, and grain sorghum. The surface layer of this soil is friable, but it becomes somewhat difficult to keep in good tilth where cultivation has mixed some of the clayey subsoil into the plow layer. A drainage system is needed for most cultivated crops. Land grading and smoothing improve surface drainage and permit more efficient use of farm equipment. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Nonlegume crops respond well to nitrogen fertilizer. Lime or other fertilizer is generally not needed.

This soil is well suited to use as pasture. The level slopes and high fertility are favorable soil features for this use. The main limitation is wetness. Suitable pasture plants are common bermudagrass, tall fescue, dallisgrass, improved bermudagrass, white clover, and winter peas. Annual cool-season grasses, such as ryegrass or wheat, are suitable for winter forage. Grazing when the soil is wet results in compaction of the surface layer. Shallow ditches can remove excessive water that accumulates on the surface. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and the soil in good condition. Nitrogen fertilizer is needed if grasses are grown alone, but lime and other fertilizer is generally not needed.

This Moreland soil is well suited to use as woodland; but most areas are used as cropland or pasture. Common trees are sugarberry, sweetgum, Nuttall oak, water oak, and green ash. The main concern in producing and harvesting timber is wetness, which severely limits the use of equipment and increases seedling mortality. Suitable trees to plant are eastern cottonwood and American sycamore. Planting trees on bedded rows lowers the effective depth of the water table and reduces seedling mortality. Rutting and soil compaction can be reduced by using suitable logging systems, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction.

This soil is well suited to use as habitat for woodland and wetland wildlife. Habitat for whitetail deer, squirrels, and many species of nongame birds and animals can be improved by planting or encouraging the growth of existing oak trees and suitable understory plants. Fence lines, ditchbanks, and abandoned building sites provide habitat for birds and small animals if vegetation is allowed to grow naturally. Habitat for wetland wildlife can be improved by constructing shallow ponds to provide open water areas for waterfowl and furbearing animals, such as muskrat, nutria, and otter.

This soil is poorly suited to urban uses. It has severe limitations for building sites, local roads and streets, and most sanitary facilities. The main limitations are wetness, very slow permeability, very high shrink-swell potential, low strength for roads, and the hazard of flooding. Buildings can be placed on pilings or mounds to elevate them above expected flood levels. Excess surface water can be removed by using shallow ditches and providing the proper grade. Septic tank absorption fields do not function properly during rainy periods because of wetness and very slow permeability. Lagoons or self-contained sewage disposal units can be used to dispose of sewage properly. If buildings are constructed on this soil, structural damage as a result of shrinking and swelling can be prevented by properly designing foundations and footings, and diverting runoff from buildings. Roads and streets should be designed to compensate for the low strength and instability of the subsoil.

This Moreland soil is in capability subclass IIIw. The woodland ordination symbol is 7W.

Mn—Moreland clay. This soil is level and somewhat poorly drained. It is in low positions on natural levees on the Red River alluvial plain. The areas of this soil are broad and are 50 to several hundred acres. Slopes are generally less than 1 percent.

Typically, the surface layer is dark reddish brown, neutral clay about 16 inches thick. The subsoil to a depth of about 63 inches is dark reddish brown, neutral clay in the upper part and reddish brown, mildly alkaline clay in the middle and lower parts. In places, the lower part of the subsoil is gray or grayish brown silt loam, silty clay loam, or clay.

Included with this soil in mapping are a few small areas of Gallion, Latanier, and Perry soils. Also included in low positions are small areas of Moreland soils that are subject to occasional or frequent flooding. Gallion soils are in higher positions than the Moreland soil and are loamy throughout the profile. Latanier soils are in slightly higher positions and have loamy underlying material. Perry soils are in slightly lower positions and do not have a dark reddish brown surface layer. The included soils make up about 15 percent of the map unit.

This Moreland soil has high fertility. Wetness causes poor aeration and restricts root development of many plants. Water and air move through this soil at a very slow rate. Water runs off the surface slowly and stands in low places for long periods after heavy rains. A seasonal high water table is within 1.5 feet of the soil surface from December to April. Flooding is rare, but it can occur under abnormal or catastrophic conditions. It generally occurs less often than once in 10 years and at anytime during the year. This soil has very high shrink-swell potential. Plants are damaged by lack of water during dry periods in summer and fall of some years.

This soil is mainly used as cropland or pasture. In a few areas, it is used as woodland or homesites.

This soil is moderately well suited to most cultivated crops. The level slopes and high fertility are favorable soil features for cultivated crops, but wetness and a clayey surface layer are less favorable features. The main suitable crops are cotton, soybeans, grain sorghum, wheat, and rice (fig. 6). This soil is difficult to keep in good tilth and can be worked only within a narrow range of moisture content. The surface layer is sticky when wet and hard when dry and becomes cloddy if farmed when too wet or too dry. A drainage system is needed for most cultivated crops. Land grading and smoothing improve surface drainage and permit more efficient use of farm equipment. Crop residue on or near the surface helps to maintain tilth and improves water intake. Nonlegume crops respond well to nitrogen fertilizer. Lime or other fertilizer is generally not needed.

This soil is well suited to use as pasture; however, wetness and the clayey surface layer are limitations. Suitable pasture plants are common bermudagrass, tall fescue, improved bermudagrass, dallisgrass, white clover, and winter peas. Annual cool-season grasses, such as ryegrass or wheat, are suitable for winter forage. Grazing when the soil is wet results in compaction of the surface layer. Shallow ditches can remove excess surface water. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the

Figure 6.—Winter wheat is a common crop on Moreland clay in Natchitoches Parish. Wheat can be successfully double cropped with soybeans in some years.

pasture and the soil in good condition. Nitrogen fertilizer is needed if grasses are grown alone, but lime and other fertilizers generally are not needed.

This Moreland soil is well suited to use as woodland, but most areas have been cleared and are used as cropland or pasture. Common trees are sugarberry, Nuttall oak, sweetgum, water oak, and green ash. The main concerns in producing and harvesting timber are wetness and the clayey surface layer, which severely limit the use of equipment and increase seedling mortality. Suitable trees to plant are eastern cottonwood and American sycamore. Planting and harvesting should be done during the drier periods to prevent rutting and soil compaction. Planting trees on bedded rows lowers the effective depth of the water table and reduces seedling mortality.

This soil is well suited to use as habitat for woodland and wetland wildlife. Habitat for whitetail deer, squirrels, and many species of nongame birds and animals can be improved by planting or encouraging the growth of

habitat for birds and small animals if vegetation is allowed to grow naturally. Habitat for wetland wildlife can be improved by constructing shallow ponds to provide open water areas for waterfowl and furbearing animals, such as muskrat, nutria, and otter.

This soil is poorly suited to urban uses. It has severe limitations for building sites, local roads and streets, and most sanitary facilities. The main limitations are wetness, very slow permeability, very high shrink-swell potential, low strength for roads, and the hazard of flooding. Buildings can be placed on pilings or mounds to elevate them above expected flood levels. Excess surface water can be removed by using shallow ditches and providing the proper grade. Septic tank absorption fields do not function properly during rainy periods because of wetness and very slow permeability. Lagoons or self-contained sewage disposal units can be used to dispose of sewage properly. If buildings are constructed on this soil, structural damage as a result of shrinking and buildings. Roads and streets should be designed to compensate for the low strength and instability of the subsoil.

This Moreland soil is in capability subclass IIIw. The woodland ordination symbol is 7W.

Mo—Moreland clay, gently undulating. This soil is somewhat poorly drained. It is on low, parallel ridges and swales on the Red River alluvial plain. The ridges are 1 to 3 feet high and are 100 to 250 feet wide. The swales are about 75 to 150 feet wide. The areas of this soil are

equipment, but large amounts of earth need to be moved. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Nonlegume crops respond well to nitrogen fertilizer. Lime or other fertilizer is generally not needed.

This soil is well suited to use as pasture; however, wetness and the clayey surface layer are limitations. Suitable pasture plants are common bermudagrass, tall fescue, improved bermudagrass, dallisgrass, white clover, and winter peas. Annual cool-season grasses and swelling can be prevented by properly designing foundations and footings and by diverting runoff from buildings. Roads and streets should be designed to compensate for the low strength and instability of the subsoil.

This Moreland soil is in capability subclass IIIw. The woodland ordination symbol is 7W.

Mp—Moreland clay, occasionally flooded. This soil is level and somewhat poorly drained. It is in low positions on natural levees on the Red River alluvial plain. The areas of this soil are irregular in shape and range from 15 to several hundred acres. Slopes are generally less than 1 percent.

Typically, the surface layer is dark reddish brown, neutral and mildly alkaline clay about 15 inches thick. The subsoil is dark reddish brown, mildly alkaline clay to

some years. Levees and a well-designed drainage system are needed to protect this soil from flooding. Crop residue on or near the surface helps to maintain tilth and improves the rate of water intake. Nonlegume crops respond well to nitrogen fertilizer. Lime and other fertilizers are generally not needed.

This Moreland soil is moderately well suited to use as pasture. The main limitations are wetness, the clayey surface layer, and the hazard of flooding. A suitable pasture plant is common bermudagrass. Wetness and flooding limit the choice of plants and the period of grazing (fig. 7). Grazing when the soil is wet results in compaction of the surface layer. Excessive water on the surface can be removed by shallow ditches where suitable outlets are available. Proper stocking, pasture rotation, and restricted grazing during wet periods help

Figure 7.—Flooding is a concern in managing livestock operations on Moreland clay, occasionally flooded.

lagoons or self-contained sewage disposal units can be used to dispose of sewage properly.

substratum to a depth of about 60 inches is dark grayish brown and reddish brown, moderately alkaline clay

This soil is subject to one or more brief to long periods of flooding from December to June of most years. Flooding occurs more often than twice in 5 years and at any time during the year. Depth of flood water can exceed 10 feet at the lower elevations, but it is typically 1 to 3 feet. During nonflood periods, a seasonal high water table is within 1.5 feet of the soil surface from December to April. This soil has very high shrink-swell potential. The surface layer is sticky when wet and cracks when dry. Adequate water is available to plants in most years.

This soil is mainly used as woodland or native pasture. In a few areas, it is used for short-season crops.

This soil is moderately well suited to use as woodland. Common trees are overcup oak, water hickory, baldcypress, black willow, water locust, and green ash

Ms—Morse clay, 5 to 12 percent slopes. This soil is strongly sloping and well drained. It is on side slopes on the uplands. Well-defined drainageways cross most areas. The areas of this soil are irregular in shape and range from 15 to 100 acres. Slopes are generally short and complex.

Typically, the surface layer is dark reddish brown, mildly alkaline clay about 4 inches thick. The next layer is reddish brown, moderately alkaline clay to a depth of about 16 inches. The underlying material to a depth of about 60 inches is reddish brown, mildly alkaline clay in the upper part and red, mottled, mildly alkaline clay in the lower part. Concretions and masses of soft calcium carbonate are common in the underlying material.

Included with this soil in mapping are a few small areas of Acadia, Gore, and Guyton soils. Also included

Figure 8.—During dry periods, deep, wide cracks form in the surface layer and subsoil of Morse clay, 5 to 12 percent slopes.

waterfowl, and furbearing animals, such as nutria, muskrat, mink, and otter.

This Morse soil is somewhat poorly suited to use as pasture. The main limitations are complex slopes, a severe hazard of erosion during seedbed preparation, and low fertility. Suitable pasture plants are King Ranch bluestem, johnsongrass, and Pensacola bahiagrass. Annual grasses, such as ryegrass or wheat, are suitable for winter forage. Fertilizer is needed for optimum growth of grasses and legumes. Erosion can be controlled by maintaining a good plant cover. Seedbed preparation should be on the contour or across the slope where

and short, complex slopes. Suitable crops are cotton, grain sorghum, and soybeans. Irregular slopes can hinder tillage operations. Crop residue on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Conservation tillage, terraces, diversions, and grassed waterways help control erosion. Most crops respond well to fertilizer.

This soil is poorly suited to urban development. It has severe limitations for building sites, local roads and streets, and most sanitary facilities. The main limitations are very slow permeability, low strength for roads, and very high shrink-swell potential. Because erosion is a not function properly because of the very slow permeability. Properly designed lagoons or self-contained

Tree seedlings have a moderately low rate of survival because of the long dry periods in the summer. Ripping soil are irregular in shape and range from 10 to 150 acres.

Typically, the surface layer is dark reddish brown, strongly acid sandy clay loam about 6 inches thick. The subsoil to a depth of about 46 inches is red, mottled, strongly acid clay. The substratum to a depth of about 60 inches is yellowish brown, mottled, slightly acid clay and neutral sandy clay. Greenish sand-sized grains of glauconite are common in the subsoil and substratum.

Included with this soil in mapping are a few small

palatable browse for deer and seed-producing plants for quail and turkey.

This Natchitoches soil is somewhat poorly suited to use as pasture. The main limitations are low fertility and a severe hazard of erosion during establishment of pasture grasses. Suitable pasture plants are common bermudagrass, improved bermudagrass, Pensacola bahiagrass, and crimson clover. Annual cool-season grasses, such as ryegrass or wheat, are suitable for winter forage. Proper stocking and pasture rotation help

Included with this soil in mapping are a few small areas of Latanier, Moreland, and Yorktown soils. Also included are small areas of Perry soils that are frequently

plant. Grazing when the soil is wet results in compaction of the surface layer and damage to the plant community. Excessive water on the surface can be removed by

Severn soils are in positions similar to those of the Roxana soil and are calcareous in all horizons below a depth of 10 inches. The included soils make up about 15 percent of the map unit.

soil is friable and easy to keep in good tilth. It can be worked throughout a wide range of moisture content. Traffic pans develop under continuous cultivation, but these can be broken easily by deep plowing or chiseling.

are suitable for winter forage. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition. Nitrogen fertilizer is needed where grasses are grown alone. Lime and other fertilizers are generally not needed.

This Roxana soil is well suited to use as woodland; however, only a few small areas remain in native hardwoods. Common trees are pecan, cherrybark oak, water oak, American sycamore, eastern cottonwood, and sweetgum. Trees suitable to plant are eastern cottonwood and American sycamore. The soil has few limitations for woodland use and management.

This Ruston soil has low fertility and moderately high levels of exchangeable aluminum that are potentially toxic to some crops. Water and air move through this soil at a moderate rate, and water runs off the surface at a medium rate. The shrink-swell potential is low. Plants suffer from lack of water during dry periods in summer and fall of some years.

This soil is mainly used as woodland or pasture. Small acreages are used as homesites or for cultivated crops.

This soil is well suited to use as woodland. Common trees include loblolly pine, shortleaf pine, longleaf pine, sweetgum, white oak, hickory, and southern red oak. The most sanitary facilities. The main limitations are low strength for roads and streets and moderate permeability. Septic tank absorption fields may not function properly during rainy periods because of the moderate permeability. This can be overcome by increasing the length of the absorption lines. Roads and streets should be designed to overcome the moderate load-supporting capacity of the soil.

This Ruston soil is in capability subclass IIIe. The woodland ordination symbol is 8A.

Sa—Sacul fine sandy loam, 1 to 5 percent slopes. This soil is gently sloping and moderately well drained. It is on convex ridgetops and side slopes on the uplands. The areas of this soil are irregular in shape and range from 20 to 600 acres. Slopes are generally long and smooth, but some are short and complex.

Typically, the surface layer is dark brown, strongly acid fine sandy loam about 2 inches thick. The subsurface layer is brown, strongly acid fine sandy loam to a depth of about 10 inches. The subsoil to a depth of about 58 inches is red, strongly acid, mottled clay in the upper and middle parts. The lower part of the subsoil is red, strongly acid, mottled sandy clay loam and light gray, strongly acid, mottled silty clay loam. The substratum to a depth of about 60 inches is mottled light gray and yellowish red, strongly acid sandy clay loam.

Included with this soil in mapping are a few small areas of Bellwood, Keithville, and Ruston soils. Also included are small areas of Sacul soils that have slopes of more than 5 percent. Bellwood soils are in positions similar to those of the Sacul soil and have intersecting slickensides in the subsoil. Keithville and Ruston soils are on ridgetops at a slightly higher elevation. Keithville soils are loamy in the upper part of the subsoil, and Ruston soils are reddish and loamy throughout the profile. The included soils make up about 20 percent of the map unit.

This Sacul soil has low fertility and high levels of exchangeable aluminum that are potentially toxic to most crops. Water and air move through this soil slowly, and water runs off the surface at a medium rate. No seasonal high water table has been observed in this soil. The soil has high shrink-swell potential in the subsoil. Plants generally are damaged by lack of water during dry periods in summer and fall of most years.

cuts and fills. Skid trails and firebreaks are subject to rilling and gullying unless provided with adequate water bars or protected by plant cover. Undesirable plants can reduce adequate natural or artificial reforestation; however, intensive site preparation and maintenance are generally not needed.

This soil is well suited to use as habitat for woodland wildlife. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable plants. Prescribed burning every three years, rotated among several small tracts of land, can increase the amount of palatable browse for deer and seed-producing plants for quail and turkey.

This Sacul soil is moderately well suited to use as pasture. The main limitation is low fertility, and soil erosion is a hazard during establishment of pasture grasses. Suitable pasture plants are common bermudagrass, improved bermudagrass, Pensacola bahiagrass, and crimson clover. Annual cool-season grasses, such as ryegrass or wheat, are suitable for winter forage. Fertilizer and lime are needed for optimum growth of grasses and legumes. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking and pasture rotation help keep the pasture in good condition.

This soil is somewhat poorly suited to cultivated crops. It is limited mainly by low fertility and a severe hazard of erosion. The main suitable crops are cotton, grain sorghum, wheat, soybeans, and corn. This soil is friable and easy to keep in good tilth. The surface layer erodes easily if this soil is clean tilled. Early fall seeding, conservation tillage, terraces, diversions, and grassed waterways help control erosion. All tillage should be on the contour or across the slope. Most crops respond well to lime and fertilizer, which help to overcome the low soil fertility and reduce the level of exchangeable aluminum in the root zone.

This soil is poorly suited to most urban uses. It has severe limitations for building sites, local roads and streets, and most sanitary facilities. The main limitations are slow permeability, high shrink-swell potential, and low strength for roads. Septic tank absorption fields do not function properly during rainy periods because of slow permeability. Lagoons or self-contained sewage disposal units can be used to dispose of sewage

It is on side slopes on the uplands. Well-defined drainageways cross most areas of this soil. The areas of this soil are irregular in shape and range from 30 to 400 acres. Slopes are generally short and complex.

Typically, the surface layer is dark grayish brown, strongly acid fine sandy loam about 4 inches thick. The

several small tracts of land, can increase the amount of palatable browse for deer and seed-producing plants for quail and turkey. Areas suitable for small ponds are available. These ponds can provide habitat for fish, waterfowl, and furbearing animals, such as nutria, muskrat, mink, and otter.

Included with this soil in mapping are a few small areas of Latanier, Moreland, and Roxana soils. Also included are small areas of Severn soils that are rarely flooded and areas that are frequently flooded. The Latanier and Moreland soils are in lower positions than

smoothing and aligning crop rows with the soil slope can remove excess water that accumulates after heavy rains. Proper management of crop residue helps to maintain organic matter content and tilth and reduces soil loss by erosion. Nonlegume crops respond well to nitrogen as soybeans, can be grown in some years. In other

suitable for winter forage. Seedbed preparation should

Sm—Smithdale fine sandy loam, 8 to 20 percent slopes. This soil is strongly sloping to moderately steep and well drained. It is on side slopes on the uplands. The areas of this soil are irregular in shape and range

This Smithdale soil is somewhat poorly suited to use as pasture. The main limitations are moderately steep slopes, low fertility, and a severe hazard of erosion. Suitable pasture plants are common bermudagrass.

circular mounds and Wrightsville soils along drainageways. These Wrightsville soils are subject to flooding. Acadia and Gore soils are on more convex slopes than the Wrightsville soil. Acadia soils have a subsoil that is brownish and loamy in the upper part. Gore soils have a reddish clayey subsoil. The included soils make up about 20 percent of the map unit.

This Wrightsville soil is well suited to use as pasture; however, wetness and low fertility are limitations. Suitable pasture plants are common bermudagrass, Pensacola bahiagrass, white clover, and winter peas. Wetness limits the choice of plants and the period of grazing. Excessive water on the surface can be removed by shallow ditches. Proper stocking, pasture rotation, and surface layer is reddish brown clay or very dark gray or black muck.

Included with this soil in mapping are a few small areas of Moreland and Perry soils. Also included are small areas of open water. The Moreland and Perry soils are in slightly higher positions than the Yorktown soil. These soils dry and crack to about 20 inches below the surface during dry periods in most years. The included soils and water make up about 20 percent of the map unit.

This Yorktown soil has medium fertility. Water and air move through this soil very slowly. It is subject to very long periods of ponding and flooding during anytime of the year. This soil is generally flooded continuously from late in fall to early in summer of most years. Depth of flood waters is typically 1 foot to 3 feet, but it can exceed 10 feet in places. During nonflood periods, water is ponded on the surface or the water table is within 0.5 foot of the soil surface. This soil has very high shrink-swell potential, but it seldom dries out enough to crack. Adequate water is available to plants in most years.

This soil is mainly used as habitat for wildlife. In a few areas, it is used for timber production (fig. 10).

This soil is moderately well suited to use as habitat for wetland wildlife. It produces habitat for resident and migratory waterfowl, many species of songbirds and wading birds, raccoons, nutria, muskrat, otter, and crawfish. Habitat can be improved by planting appropriate vegetation, by maintaining existing plant cover, or by encouraging the propagation of desirable

Figure 10.—Baldcypress is dominant in this area of Yorktown clay, frequently flooded.

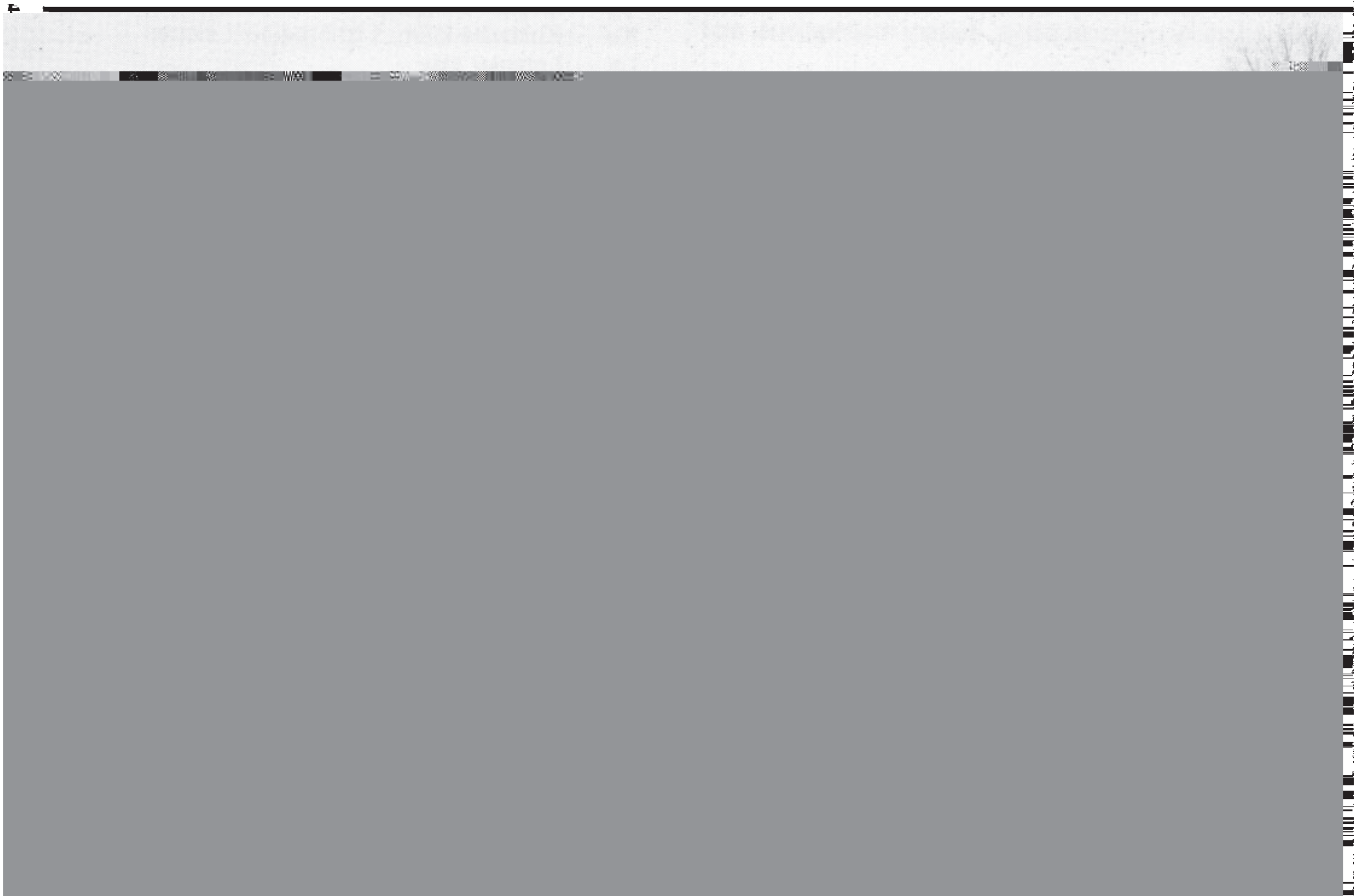
plants. Openings can be made in thickly wooded or brushy areas to encourage growth of seed-producing grasses and forbs favored by waterfowl.

This Yorktown soil is poorly suited to use as pasture mainly because of wetness and the long periods of flooding and ponding. It is generally not practical to

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Natchitoches

high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state,



to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and

map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 5. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soils that have limitations, such as a high water table or flooding, may qualify as prime farmland if these

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Paul Miletello, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 175,000 acres in Natchitoches Parish was used for crops and pasture in 1985. Of this, about 75,000 acres was used for crops, mainly soybeans (fig 12). More than 100,000 acres was used as pasture. The acreage used for crops has steadily increased as woodland and pasture have been converted to cropland.

Differences in crop suitability and management needs result from differences in soil characteristics, such as fertility levels, erodibility, organic matter content, availability of water for plant growth, drainage, and the hazard of flooding. Cropping systems and soil tillage are also an important part of management. Each farm has a unique soil pattern; therefore, each has unique management problems. Some principles of farm management, however, apply only to specific soils and certain crops. This section presents the general principles of management that can be applied widely to the soils of Natchitoches Parish.

Pasture and Hayland

Perennial grasses or legumes, or mixtures of these, are grown for pasture and hay. The mixtures generally consist of either a summer or a winter perennial grass and a suitable legume. In addition, many farmers seed small grains or ryegrass in the fall for winter and spring forage. Excess grass in summer is harvested as hay for winter.

Common and improved bermudagrass and Pensacola bahiagrass are the summer perennials most commonly grown. Improved bermudagrass and Pensacola bahiagrass produce good quality forage. Tall fescue, the chief winter perennial grass, grows well only on soils that have a favorable moisture content. All of these grasses respond well to fertilizers, particularly nitrogen.

White clover, crimson clover, vetch, and winter peas are the most commonly grown legumes. They respond well to lime, particularly on acid soils.

Proper grazing is essential for high quality forage, stand survival, and erosion control. Brush and weed

Figure 12.—Soybeans is one of the major crops grown on Roxana very fine sandy loam.

an extensive root system and an abundance of foliage.

during the fall and winter. Double cropping of wheat and

The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information

that the main limitation is risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); and *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

There are no subclasses in class I because the soils have been cleared for agricultural crops, the bottom lands once supported vast forests of oak, gum, cypress, hickory, pecan, ash, elm, and cottonwood. Only remnants of the bottom land forests are left. They generally consist of scattered low tracts, swamps, and

percent is softwoods that do not include cypress. The species that make up the oak-pine type are primarily the result of soil, slope, and aspect. On the higher, drier sites, the hardwood components tend to be upland oaks, can help determine specific woodland management needs.

Production of Forage in Woodland

The kind and amount of understory vegetation that can be produced in an area is related to the soils.

indicator species is a tree that is common in the area and that is generally the most productive on a given soil.

Table 8 lists the *ordination symbol* for each soil. The first part of the ordination symbol, a number, indicates the potential productivity of a soil for the indicator species in cubic meters per hectare. The larger the slope, if soil wetness restricts equipment use for more than 6 months per year, if stoniness restricts ground-based equipment, or if special equipment is needed to avoid or reduce soil compaction. Ratings of *moderate* or *severe* indicate a need to choose the most suitable equipment and to carefully plan the timing of harvesting and other management operations.

Ratings of *seedling mortality* refer to the probability of death of naturally occurring or properly planted seedlings of good stock in periods of normal rainfall as influenced by kinds of soil or topographic features. *Seedling*

Trees to plant are those that are used for reforestation or, if suitable conditions exist, natural regeneration. They are suited to the soils and will produce a commercial wood crop. Desired product, topographic position (such as a low, wet area), and personal preference are three factors of many that can influence the choice of trees to use for reforestation.

Recreation

In table 9, the soils of the survey area are rated during the period of use, and do not have slopes, stones, or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during

fox squirrel, swamp rabbit, raccoon, bobcat, coyote, wild turkey, and many birds, reptiles, and amphibians.

About 136,000 acres of forest land in the parish is public lands within the Kisatchie National Forest. These public lands are managed for multiple use of the resources. The public forest land in the southern and southwestern parts of the parish has an excellent population of wild turkeys. Part of the National Forest in the Kisatchie Hills area has been designated as a National Wilderness Area.

The many ponds, lakes, bayous, and rivers of the parish support small to large populations of fish. Major species include largemouth bass, white bass, yellow

Figure 13.—This pond in a wooded area of Beauregard silt loam, 1 to 3 percent slopes, provides water for livestock and enhances the habitat for wetland and woodland wildlife.

are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, rice, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bermudagrass, bahiagrass, clover, and vetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, crabgrass, and wooly croton.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, sugarberry, cherry, sweetgum, persimmon, hawthorn, dogwood, hickory, blackberry, and huckleberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, blueberry, and mayhaw.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and baldcypress.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are American beautyberry, American elder, yaupon, and Allegheny chinkapin.

Wetland plants are annual and perennial, wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less

Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet, and because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations must be considered in planning, in site selection, and in design.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to [illegible]

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts and sodium affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that [illegible] local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant-available nutrients as it decomposes.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement, permeability, depth to a high water table or depth of standing water if the soil is subject to ponding, slope, and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts or sodium. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to

performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(3)* and the system adopted by the American Association of State Highway and Transportation Officials *(2)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from nearby areas and on field examination.

Physical and Chemical Properties

Soil reaction is a measure of acidity or alkalinity and is infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive

weather conditions (there is more than a 40 percent chance of flooding in any year). *Common* is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. June-November, for example, means that flooding can occur during the period June through November. About two-thirds to three-fourths of all flooding occurs during the stated period.

The definitions of the frequency of flooding for the on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and the amount of sulfates in the saturation extract.

Soil Fertility Levels

Dr. M.C. Amacher and Dr. B.J. Miller, Department of Agronomy, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, prepared this section.

This section gives information concerning the environmental factors and the physical and chemical properties of the soils that affect the potential for crop production. It also lists the methods used to obtain the chemical analyses of the soils sampled.

Crop composition and yield are a function of many soil, plant, and environmental factors. A list and brief description of the more important factors follows:

Environmental factors:

- Light—intensity and duration
- Temperature—air and soil
- Precipitation—distribution and amount
- Atmospheric carbon dioxide concentration

Plant factors (species and hybrid specific):

- Rate of nutrient and water uptake
- Rate of growth and related plant functions

Soil factors—chemical properties:

- Quantity factor—Amount of an element in the soil that is readily available for uptake by plants. To determine the quantity factor, the available supply of an element is removed from the soil, using a suitable extractant, and is analyzed.
- Intensity factor—The concentration of an element species in the soil moisture. It is a measure of the availability of an element for uptake by plant roots. Two soils that have identical quantities of an element's available supply, but have different element intensity factors will differ in element availability to the plant.
- Relative intensity factor—Effect that the availability of one element has on the availability of another element.
- Quantity/Intensity relationship factor—The relationship includes the reactions between the soil surface and soil water that control the distribution of element species between the available supply in the soil and the soil water. A special quantity/intensity relationship is the buffer capacity of the soil for a given element. The buffer capacity is the amount of a given element that must be added to or removed from the available supply to produce a given change in the intensity factor for that element.
- Replenishment factor—Rate of replenishment of the available supply and intensity factors by weathering reactions, fertilizer additions, and transport by mass flow and diffusion.

These soil factors are interdependent. The magnitude of the factors and the interactions among them control crop response. The relative importance of each factor changes from soil to soil, crop to crop, and environment to environment. The soil factors are only part of the overall system.

The goal of soil testing is to provide information for a soil and crop management program that establishes and maintains optimum levels and balance of the essential elements in the soil for crop and animal nutrition and protects the environment against the buildup of potentially toxic levels of essential and nonessential elements. Current soil tests measure only one soil factor, the available supply of nutrients in the surface or plow layer. Where crop production is clearly limited by the available supply of one or more nutrients in the plow layer, existing soil tests generally can diagnose the problem and reliable recommendations to correct the problem can be made. Soil management systems inherent ability to supply nutrients to plant roots and to provide a favorable environment for root growth. If soil fertility recommendations based on current soil tests are followed, major fertility problems in the plow layer are normally corrected. Crop production is then limited by crop and environment factors, physical properties of the plow layer, and physical and chemical properties of the subsoil.

Although the soil's available nutrient supply is only one factor affecting crop production, it is an important factor. Information on the available nutrient supply in the subsoil allows evaluation of the native fertility levels of the soil.

Soils were sampled during the soil survey and

early in the growing season if the levels of available nutrients in the surface horizon are low enough. If the crop roots are able to penetrate to the more fertile subsoil, deficiency symptoms often disappear.

The third type includes soils that have adequate or relatively high levels of available nutrients in the surface layer, but have relatively low levels in the subsoil. Such soils developed from low fertility parent material or are older soils that have been subjected to more intense weathering over a longer period of time. The higher nutrient levels in the surface horizon generally are a result of fertilizer additions to agricultural soils or biocycling in undisturbed soils.

The Bray 2 extractant tends to extract more phosphorus than the more commonly used Bray 1, Mehlich I, and Olsen extractants. The Bray 2 extractant provides an estimate of the plant available supply of phosphorus in soils. According to the soil test interpretation guidelines used in Louisiana, the Bray 2 extractable phosphorus content of most of the soils in Natchitoches Parish is very low. The very low levels of available phosphorus are a limiting factor in crop production. The soils require continual additions of fertilizer phosphorus to build up and maintain adequate levels of available phosphorus for sustained crop production.

The Betis, Bienville, Caddo, Gore, Shatta, and Wrightsville soils contain very low levels of extractable phosphorus throughout the soil profile. The Cahaba soil contains a high level of extractable phosphorus in the surface layer. This is most likely a result of the recent addition of fertilizer phosphorus. The Caspiana, Moreland, Roxana, and Severn soils contain variable amounts of phosphorus, but these levels are in the medium to high range. The extractable phosphorus content of the Gallion, Morse, Perry, and Yorktown soils increases with depth and ranges from medium to high according to soil test interpretation guidelines. The subsoil of the Caspiana and Gallion soils can be a significant source of available phosphorus to plants as

same or increases with depth. Increases in exchangeable potassium with depth can be associated with increasing clay content. The exchangeable potassium levels in the Natchitoches soils that developed from unconsolidated alkaline clays are generally high throughout the soil profile. The exchangeable potassium content of the Beauregard and Shatta soils is generally low throughout the soil profile. The exchangeable potassium content in the Latanier, Moreland, Perry, and Yorktown soils is much higher than that of most of the other soils in the parish because of a higher clay content, but according to soil test interpretation guidelines, it is still in the low to medium range depending on the soil texture. The soils that have a relatively low clay content, such as the Severn soils, generally contain low amounts of exchangeable potassium. The higher levels of exchangeable potassium generally are in the loamy and clayey soil horizons. Higher levels are also in soils where fertilizer potassium has been applied.

Crops respond to fertilizer potassium if exchangeable potassium levels are very low to low. Low levels can be gradually built up by adding fertilizer potassium if the soils contain a sufficient amount of clay to hold the potassium. Exchangeable potassium levels can be maintained by adding enough fertilizer potassium to make up for that removed by crops, the fixation of magnesium levels in the Gallion soils generally increase

soil, several decades of adding large amounts of organic levels of organic matter can also alleviate aluminum toxicity.

Sources of exchangeable hydrogen in soils include hydrolysis of exchangeable and nonexchangeable aluminum and pH-dependent exchange sites on metal oxides, certain layer silicates, and organic matter. Exchangeable hydrogen as determined by extraction with such neutral salts as potassium chloride is normally not a major component of soil acidity because it is not readily replaceable by other cations unless accompanied by a neutralization reaction. Most of the neutral salt exchangeable hydrogen in soils apparently comes from aluminum hydrolysis.

Acidity from hydrolysis of neutral salt exchangeable aluminum plus neutral salt exchangeable hydrogen from

exchange capacity at the pH of the soil and methods that use buffered salts to measure the cation exchange capacity at a specified pH. These methods produce different results since unbuffered salt methods include only a part of the pH-dependent cation exchange capacity and the buffered salt methods include all of the pH-dependent cation exchange capacity up to the pH of the buffer (generally pH 7 or 8.2). Errors in the saturation, washing, and replacement steps can also cause different results.

The effective cation exchange capacity is the sum of exchangeable bases determined by extraction with pH 7, 1 molar ammonium acetate plus the sum of neutral salt exchangeable aluminum and hydrogen (exchangeable acidity). The sum cation exchange capacity is the sum of reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(36)*.

Coarse materials—(2-75 mm fraction) weight estimates of the percentages of all materials less than 75 mm

Moist bulk density—of less than 2 mm material, saran-coated clods; field moist (4A3a), air dry (4A1b), oven dry (4A1h).

Linear extensibility—change in clod dimension based on less than 2 mm material (4D).

Organic carbon—dichromate, ferric sulfate titration (6A1a).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(34)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 22 shows the classification of the soils in the survey area. The

characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil the Acadia series are fine, montmorillonitic, thermic Aeric Ochraqualfs.

The Acadia soils in Natchitoches Parish are taxadjuncts to the Acadia series because they typically have a clay loam Btg1 horizon. This difference is outside the defined range for the series, but it does not significantly affect use and management of these soils.

Acadia soils commonly are near Gore, Shatta, and Wrightsville soils. The Gore soils are on slopes at a lower elevation than the Acadia soils and have a reddish subsoil. The Shatta soils are in slightly higher positions and are fine-silty. The Wrightsville soils are in slightly lower positions and have a thick subsurface layer that extends downward into the subsoil.

Typical pedon of Acadia silt loam; about 6.5 miles northwest of Campti on Highway 480 to Grappes Bluff, 0.3 mile west on Highway 480 from junction of parish road, 300 feet north of center of highway; SW1/4SE1/4 sec. 20, T. 11 N., R. 8 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many fine and very fine roots; few medium brown and black concretions; very strongly acid; abrupt wavy boundary.

E—6 to 8 inches; light yellowish brown (10YR 6/4) silt loam; few fine faint yellowish brown mottles; weak medium subangular blocky structure; friable; common fine and medium roots; very strongly acid; abrupt wavy boundary.

BE—8 to 16 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles and common medium faint light

percent or more saturated with exchangeable aluminum within a depth of 30 inches.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is 4 to 8 inches thick. Reaction ranges from very strongly acid to medium acid.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4, or has hue of 2.5Y, value of 5, and chroma of 2. It is 2 to 10 inches thick. The texture is silt loam, loam, or very fine sandy loam. Reaction ranges from very strongly acid to medium acid.

The BE horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 8. The texture is silt loam, clay loam, or silty clay loam. Reaction is very strongly acid or strongly acid. Some pedons have interfingering of albic material into the lower part of the BE horizon or upper part of the Btg horizon.

The Btg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2; or it has hue of 2.5Y, value of 5 or 6, and chroma of 2. The texture of the Btg1 horizon is clay loam, silty clay loam, or silty clay. The Btg2 horizon is clay or silty clay. Reaction ranges from very strongly acid to medium acid.

The Cg horizon has the same range in color as the Btg horizon. The texture is clay, silty clay, or silty clay loam. Reaction ranges from very strongly acid to mildly alkaline.

Anacoco Series

The Anacoco series consists of somewhat poorly drained, very slowly permeable soils that formed in clayey marine sediment of Tertiary age. These soils are

E—5 to 10 inches; light brownish gray (10YR 6/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; many fine and medium roots; very strongly acid; clear wavy boundary.

Bt1—10 to 20 inches; light brownish gray (2.5Y 6/2) silty clay; common medium prominent yellowish red (5YR

table is 1.5 to 3 feet below the soil surface from December to April in most years. Slope is generally less than 1 percent. Soils of the Armistead series are fine-silty, mixed, thermic Aquic Argiudolls.

Armistead soils commonly are near the Caspiana, Gallion, Latanier, and Moreland soils. Caspiana and Gallion soils are in slightly higher positions on the natural carbonate; slight effervescence; moderately alkaline; clear wavy boundary.

3C—43 to 60 inches; reddish brown (2.5YR 4/4) clay; weak coarse subangular blocky structure; very firm; common pressure faces; common fine black stains; common fine to coarse soft masses of calcium carbonate; few fine hard nodules of calcium carbonate; strong effervescence; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness.

The A horizon has hue of 5YR or 2.5YR, value of 2 or 3, and chroma of 2 or 3. It is 10 to 20 inches thick. Reaction ranges from slightly acid to moderately alkaline.

The 2A horizon has hue of 5YR, value of 3, and chroma of 1 to 3; or it has hue of 2.5YR, value of 3, and chroma of 2. The texture is silt loam or silty clay loam. Mottles that have chroma of 1 or 2 range from few to common. Reaction ranges from neutral to moderately alkaline.

The 2Bt and 2BC horizons have hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 to 8. The texture is silt loam or silty clay loam. Reaction ranges from slightly acid to moderately alkaline.

The 3C horizon is in shades of brown or red. The texture is variable and ranges from very fine sandy loam to clay. Reaction ranges from neutral to moderately alkaline. The 3C horizon is typically calcareous.

Beauregard Series

The Beauregard series consists of moderately well drained, slowly permeable soils that formed in loamy stream deposits of Pleistocene age. These soils are on uplands. A seasonal high water table is 1.5 to 3 feet below the soil surface from December to March in most years. Slopes range from 1 to 3 percent. Soils of the Beauregard series are fine-silty, siliceous, thermic Plinthaquic Paleudults.

Beauregard soils commonly are near Caddo, Guyton, and Malbis soils. The Caddo and Guyton soils are in lower positions than the Beauregard soils and are grayish throughout the profile. Malbis soils are on slightly higher, more convex ridgetops and side slopes, and they are fine-loamy.

Typical pedon of Beauregard silt loam, 1 to 3 percent slopes; about 8 miles east of Creston, 7.3 miles east from Creston on Highway 156, 2.2 miles southeast on parish road to Highway 1226, 1.1 miles east on parish road, 450 feet south of road; SE1/4SE1/4 sec. 31, T. 12 N., R. 5 W.

A—0 to 5 inches; very dark gray (10YR 3/1) silt loam; weak fine granular structure; friable; many fine and very fine roots; medium acid; clear smooth boundary.

E—5 to 10 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; many fine and medium roots; strongly acid; clear smooth boundary.

BE—10 to 15 inches; yellowish brown (10YR 5/6) silt loam; dark grayish brown (10YR 4/2) silt loam (E) in root channels; weak fine subangular blocky structure; friable; common fine and medium roots; strongly acid; clear smooth boundary.

Bt—15 to 22 inches; yellowish brown (10YR 5/6) silt loam; many fine faint pale brown mottles and common medium prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; friable; common fine and medium roots; thin discontinuous clay films on faces of peds; few fine concretions of iron and manganese; strongly acid; clear wavy boundary.

Btv1—22 to 33 inches; yellowish brown (10YR 5/6) silt loam; many fine prominent yellowish red (5YR 5/8) mottles, common medium faint light brownish gray (10YR 6/2) mottles, and few fine faint pale brown mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; thin discontinuous clay films on faces of peds; few fine concretions of iron and manganese; about 6 percent nonindurated plinthite; strongly acid; gradual wavy boundary.

Btv2—33 to 53 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles with yellowish red (5YR 5/8) centers; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous clay films on faces of peds; about 7 percent plinthite nodules; strongly acid; gradual wavy boundary.

Btg—53 to 60 inches; light gray (10YR 7/1) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles with red (2.5YR 4/8) centers; strong medium subangular blocky structure; firm, brittle; few thin patchy clay films on faces of peds; strongly acid.

The solum ranges from 50 to 90 inches in thickness. Depth to horizons that contain more than 5 percent plinthite ranges from 20 to 40 inches. The effective cation exchange capacity is 50 percent or more saturated with exchangeable aluminum within a depth of 30 inches.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 1 to 3. It is 2 to 5 inches thick. Reaction ranges from strongly acid to slightly acid.

The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. The texture is very fine sandy loam or silt loam. It is 2 to 7 inches thick. Reaction ranges from strongly acid to slightly acid.

The Bt part of the BE horizon and the Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. Mottles are in shades of red, brown, or gray. The texture is silt loam or silty clay loam. Reaction ranges from very strongly acid to medium acid.

The Btv1 horizon has color and reaction similar to that of the Bt horizon. The Btv2 horizon has hue of 10YR and 2.5Y, value of 5 to 7, and chroma of 1 to 3. Mottles in shades of gray, red, or brown range from few to many in the Btv1 and Btv2 horizons. Nodules of plinthite make up from 5 to 10 percent of the volume of these horizons. The texture of the Btv horizon is silt loam or silty clay loam. Reaction ranges from very strongly acid to medium acid.

The Btg horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 3. Mottles in shades of brown or red range from few to many. The texture is silt loam or silty clay loam. Reaction ranges from very strongly acid to medium acid.

Bellwood Series

The Bellwood series consists of somewhat poorly drained, very slowly permeable soils that formed in very fine, clayey sediment of Tertiary age. These soils are on uplands. A seasonal high water table is 2 to 4 feet below the soil surface from December to April in most years. Slopes range from 1 to 12 percent. Soils of the Bellwood series are very-fine, montmorillonitic, thermic Aquentic Chromuderts.

Bellwood soils are similar to Gore and Morse soils and

blocky structure; very firm; common fine roots; discontinuous shiny pressure faces; many intersecting slickensides; gleying around roots; extremely acid; clear smooth boundary.

BC1—41 to 55 inches; pale brown (10YR 6/3) clay; common medium prominent strong brown (7.5YR 5/6) mottles and few fine prominent yellowish red (5YR 5/6) mottles; weak coarse and medium angular blocky structure; very firm; discontinuous shiny pressure faces; common intersecting slickensides; extremely acid; clear smooth boundary.

BC2—55 to 60 inches; pale brown (10YR 6/3) clay; common fine faint yellowish brown mottles; weak coarse angular blocky structure; very firm; shiny pressure faces; few slickensides; extremely acid.

The solum ranges from 50 to 80 inches in thickness. Depth to intersecting slickensides ranges from 7 to 21 inches. Reaction ranges from extremely acid to strongly acid throughout the solum. The effective cation exchange capacity is 50 percent or more saturated with exchangeable aluminum within a depth of 30 inches.

The A horizon has hue of 10YR, 5YR, or 2.5YR, value of 3 or 4, and chroma of 1 to 4. It is 1 to 3 inches thick. The texture is very fine sandy loam or silty clay loam.

many fine and medium roots; strongly acid; clear wavy boundary.

A2—9 to 34 inches; brown (7.5YR 5/4) loamy fine sand; single grained; loose; many fine and medium roots; medium acid; gradual wavy boundary.

Bw—34 to 48 inches; yellowish red (5YR 5/6) loamy fine sand; weak medium granular structure; clay coatings on some sand grains; very friable; few fine and medium roots; few pockets of clean sand grains; strongly acid; gradual wavy boundary.

Bt—48 to 60 inches; yellowish red (5YR 5/6) loamy fine sand; moderate medium granular structure; very friable; few fine and medium roots; coated sand grains and some clay bridging on lamellae; few pockets of clean sand grains; strongly acid; gradual wavy boundary.

The solum ranges from 60 to 80 inches in thickness. Reaction ranges from very strongly acid to medium acid throughout the solum except where lime has been added. The effective cation exchange capacity is 20 to

those of the Bienville soils and are fine-loamy. The Guyton soils are in lower positions and are fine-silty. Lotus soils are on natural levees along stream channels. They have a seasonal high water table within 3 feet of the soil surface and have chroma of 1 to 3 throughout the profile.

Typical pedon of Bienville loamy fine sand, 1 to 5 percent slopes; about 2.9 miles east of Readhimer on Highway 126, 300 feet north of the center of Highway 126; NE1/4NW1/4 sec. 13, T. 13 N., R. 6 W.

A—0 to 12 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; many fine and medium roots; very strongly acid; clear wavy boundary.

E—12 to 24 inches; yellowish brown (10YR 5/4) loamy fine sand; massive; very friable; many fine and medium roots; extremely acid; clear wavy boundary.

B/E—24 to 40 inches; strong brown (7.5YR 5/6) loamy fine sand (Bt); common spots and streaks of yellowish brown (10YR 5/4) fine sand (E); weak

Slopes range from 1 to 20 percent. Soils of the Briley series are loamy, siliceous, thermic Arenic Paleudults.

Briley soils commonly are near Betis, Guyton, Kisatchie, Ruston, Sacul, and Smithdale soils. Betis soils are in positions similar to those of the Briley soils and are sandy throughout the profile. Guyton soils are in drainageways and are fine-silty. Kisatchie soils are at a lower elevation and have a clayey subsoil. Ruston,

Slopes are generally less than 1 percent. Soils of the Caddo series are fine-silty, siliceous, thermic Typic Glossaqualfs.

Caddo soils are similar to Wrightsville soils and commonly are near Beauregard, Guyton, and Malbis soils. Beauregard and Malbis soils are in slightly higher positions than the Caddo soils and contain more than 5 percent plinthite in the subsoil. Guyton soils are in

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It is 2 to 8 inches thick. Reaction ranges from very strongly acid to medium acid.

The Eg horizon and E part of the B/E horizon have hue of 10YR, value of 5 or 6, and chroma of 1 or 2. The texture is silt loam, loam, or very fine sandy loam. Reaction ranges from very strongly acid to medium acid.

The Bt horizon and Bt part of the B/E horizon have hue of 10YR, value of 5 to 7, and chroma of 1 or 2. Mottles in shades of red, yellow, and brown range from few to many. Content of plinthite ranges from 1 to 5 percent in some subhorizons. The texture is silt loam, loam, or silty clay loam. Reaction ranges from very strongly acid to medium acid.

Some pedons have a Cg horizon that is mottled in shades of gray, yellow, brown, or red. The texture is silt loam, loam, or silty clay loam. Reaction is strongly acid or medium acid.

Cahaba Series

The Cahaba series consists of well drained, moderately permeable soils that formed in loamy and sandy alluvium. These soils are on low stream terraces. Slopes range from 1 to 5 percent. Soils of the Cahaba

Bt2—26 to 48 inches; yellowish red (5YR 4/6) loam; moderate medium subangular blocky structure; friable; few fine roots; few thin patchy clay films on faces of some peds; very strongly acid; gradual wavy boundary.

C—48 to 66 inches; strong brown (7.5YR 5/6) fine sandy loam; common medium distinct light brownish gray (10YR 6/2) and yellowish red (5YR 5/6) mottles; massive; very friable; few fine roots; extremely acid.

The solum ranges from 36 to 60 inches in thickness. The soil ranges from extremely acid to slightly acid throughout. The effective cation exchange capacity is 20 to 50 percent saturated with exchangeable aluminum within a depth of 30 inches.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is 4 to 8 inches thick.

Some pedons have a thin E horizon that has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 2 to 4. The texture is fine sandy loam, sandy loam, or loamy fine sand.

The Bt horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8. The texture is sandy clay loam, clay loam, or loam.

Some pedons have a BC or CB horizon that is strong

A—5 to 12 inches; very dark gray (10YR 3/1) silty clay loam; weak medium subangular blocky structure; friable; few fine roots; neutral; clear smooth

Typical pedon of Gallion silt loam; about 3.6 miles east of Bermuda on Highway 1220 from Highway 119, 400 feet south from center of highway; Spanish Land Grant and they are brownish and grayish throughout the profile. Bellwood soils are at a higher elevation, are very fine-textured, and have intersecting slickensides. Morse soils are on steeper side slopes and are calcareous to the surface.

Typical pedon of Gore silt loam, 1 to 5 percent slopes;

or silty clay loam. Reaction ranges from very strongly acid to neutral.

The upper part of the BC horizon has the same range in color and texture as that of the Bt horizon. The lower part has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. Reaction of the BC horizon ranges

5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common discontinuous clay films on faces of peds; about 15 percent, by volume, tongues of light brownish gray (10YR 6/2) silt loam (E); very strongly acid; clear wavy boundary.

Btg—30 to 41 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium and coarse subangular blocky structure; friable; few thin clay films on faces of peds; very strongly acid; clear smooth boundary.

BC—41 to 60 inches; light brownish gray (10YR 6/2) clay loam; common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium and coarse subangular blocky structure; firm; few thin discontinuous clay films on faces of peds; few fine brown concretions; very strongly acid.

The solum ranges from 50 to 80 inches in thickness. Exchangeable sodium ranges from 10 to 40 percent of the sum of the cation exchange capacity in the lower part of the solum. The effective cation exchange capacity is 20 to 50 percent saturated with exchangeable aluminum within a depth of 30 inches.

The A or Ap horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It is 2 to 8 inches thick. Reaction ranges from extremely acid to medium acid.

The Eg horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. It is 11 to 24 inches thick. The texture is silt loam or very fine sandy loam. Reaction ranges from extremely acid to medium acid. Tongues of E material extend into the B/E horizon.

The Btg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. The texture is silt loam, silty

defined range for the series, but it does not significantly affect use and management of these soils.

Keithville soils commonly are near Bellwood, Malbis, Natchitoches, and Sacul soils. Bellwood and Natchitoches soils are at a lower elevation and are clayey throughout the subsoil. Malbis soils are in slightly higher positions than the Keithville soils and are fine-loamy. Sacul soils are at a lower elevation and have a subsoil that is clayey in the upper part.

Typical pedon of Keithville loam, 1 to 5 percent slopes; about 3 miles west of Chestnut, 3.5 miles west and southwest on parish road from Chestnut post office to road junction, 0.15 mile west of junction, 5 feet south of road; NE1/4SE1/4 sec. 3, T. 12 N., R. 7 W.

A—0 to 7 inches; dark brown (10YR 4/3) loam; weak fine granular structure; very friable; many fine and medium roots; very strongly acid; clear smooth boundary.

Bt1—7 to 14 inches; strong brown (7.5YR 5/6) loam; few fine faint brownish yellow mottles; weak fine subangular blocky structure; friable; many fine roots; common fine pores; common medium soft dark brown concretions of iron-manganese; thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—14 to 22 inches; strong brown (7.5YR 5/6) clay loam; few fine faint brownish yellow mottles; moderate medium subangular blocky structure; firm; many fine roots; few medium and coarse dark brown concretions of iron-manganese; thin patchy clay films on faces of peds; very strongly acid; clear wavy boundary.

B/E—22 to 26 inches; brownish yellow (10YR 6/6) clay

The solum is more than 60 inches thick. Reaction

firm; few fine roots; thin patchy clay films on faces east on field road, 200 feet south of center of field road; Spanish Land Grant 70, T. 6 N., R. 4 W.

Ap—0 to 6 inches; dark brown (7.5YR 3/2) clay; strong coarse subangular blocky structure; very firm; few fine roots; neutral; gradual wavy boundary.

A—0 to 2 inches; grayish brown (10YR 5/2) sand; weak fine granular structure; very friable; many fine and medium roots; slightly acid; clear smooth boundary.

C—2 to 10 inches; light brownish gray (10YR 6/2) sand; single grained; loose; many fine and medium roots; medium acid; clear wavy boundary.

Lookout Tower, 4.7 miles southeast on Forest Service Road 350, 150 feet south of road; SW1/4SE1/4 sec. 7, T. 5 N., R. 7 W.

A—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam; few fine faint dark grayish brown mottles; weak medium granular structure; very friable; common fine and medium roots; common medium pores; very strongly acid; gradual wavy boundary.

E—6 to 10 inches; yellowish brown (10YR 5/4) fine sandy loam; few coarse faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; few fine roots; common fine and medium tubular pores; strongly acid; gradual wavy boundary.

BE—10 to 17 inches; strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; few fine roots; few fine and medium tubular pores; very strongly acid;

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 4. Some pedons do not have an E horizon.

The BE and Bt horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. Some pedons do not have a BE horizon. The Btv horizon has colors similar to those of the Bt horizon, and includes hue of 10YR, value of 6, and chroma of 6 or 8 and hue of 10R, value of 6, and chroma of 6 or 8 with shades of gray in the lower part. The texture of the BE, Bt, and Btv horizons is loam, sandy clay loam, or clay loam. Reaction is very strongly acid or strongly acid. Content of plinthite in the Btv horizon ranges from 5 to 25 percent.

Moreland Series

The Moreland series consists of somewhat poorly drained, very slowly permeable soils that formed in firm; few fine roots; few shiny pressure faces; neutral; gradual wavy boundary.

Bk1—26 to 52 inches; reddish brown (5YR 4/3) clay; few fine distinct gray (N 5/0) mottles; moderate medium subangular blocky structure; very firm; common pressure faces and slickensides; common fine and medium masses of carbonates; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk2—52 to 63 inches; reddish brown (5YR 4/4) clay; weak coarse angular blocky structure; firm; common pressure faces and slickensides; common fine and medium hard and soft masses of carbonates; strong effervescence; few dark stains; mildly alkaline.

The solum ranges from 40 to more than 60 inches in thickness. Depth to calcareous layers ranges from 10 to 40 inches.

The A horizon has hue of 5YR or 7.5YR, value of 3, and chroma of 2 or 3. It is 7 to 20 inches thick. The

A—0 to 4 inches; dark reddish brown (5YR 3/3) clay; weak medium granular structure; firm; many fine and medium roots; moderate effervescence; mildly alkaline; clear wavy boundary.

AC—4 to 16 inches; reddish brown (5YR 4/4) clay; weak coarse subangular blocky structure; very firm; common fine and medium roots; strong effervescence; moderately alkaline; clear wavy boundary.

C1—16 to 30 inches; reddish brown (5YR 4/4) clay; weak very coarse subangular blocky structure; very firm; few fine roots; many black stains; common large intersecting slickensides in the lower part; common soft brown masses of calcium carbonate; common fine and medium concretions of calcium carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—30 to 60 inches; red (2.5YR 4/6) clay; few fine prominent pale brown (10YR 6/3) mottles; moderate coarse subangular blocky structure; very firm;

A—0 to 4 inches; dark reddish brown (5YR 3/2) sandy clay loam; weak fine granular structure; friable; common medium roots; strongly acid; clear wavy

Oula soils are similar to Gore soils and commonly are near Anacoco, Betis, Guyton, Kisatchie, and Smithdale soils. Anacoco soils are on ridgetops at a higher structure; very firm; few fine, medium, and coarse roots; few thin patchy clay films on faces of peds; extremely acid; gradual wavy boundary.

C—50 to 63 inches; light brownish gray (2.5Y 6/2) silty clay; few medium distinct olive yellow (2.5Y 6/6) mottles and few medium prominent dark yellowish brown (10YR 4/4) mottles; weak very coarse subangular blocky structure; faint rock structure; very firm; very few fine roots; extremely acid

300 feet east of trail end; NE1/4SW1/4 Spanish Land Grant 63, T. 7 N., R. 6 W.

A—0 to 6 inches; gray (10YR 5/1) clay; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very firm; few fine roots; medium acid; clear smooth boundary.

Bg1—6 to 14 inches; gray (10YR 5/1) clay; many

Roxana series are coarse-silty, mixed, nonacid, thermic Typic Udifluvents.

Roxana soils commonly are near Gallion, Latanier, and Severn soils. Gallion soils are on natural levees of abandoned distributary channels and have a well-developed subsoil. Latanier soils are in lower positions than the Roxana soils and have a clayey surface layer and subsoil. Severn soils are in positions similar to those of the Roxana soils, and they are calcareous in all horizons below a depth of 10 inches.

Typical pedon of Roxana very fine sandy loam; about 1 mile east of Natchitoches, 1.7 miles northeast on Highway 1224 from its junction with Highway 1, 600 feet south of center of road; N1/2 sec. 22, T. 9 N., R. 7 W.

Ap—0 to 6 inches; yellowish red (5YR 4/6) very fine sandy loam; weak fine granular structure; very friable; common fine and very fine roots; neutral; abrupt smooth boundary.

C1—6 to 19 inches; yellowish red (5YR 5/6) very fine sandy loam; weak fine granular structure; very friable; common fine roots; neutral; clear smooth boundary.

C2—19 to 27 inches; yellowish red (5YR 5/6) very fine sandy loam; massive; very friable; few fine roots; distinct bedding planes; slight effervescence; moderately alkaline; clear smooth boundary.

C3—27 to 42 inches; yellowish red (5YR 4/6) silt loam; massive; very friable; few fine roots; distinct bedding planes; strong effervescence; moderately alkaline; abrupt smooth boundary.

2Ab—42 to 48 inches; dark brown (10YR 3/3) silt loam; weak medium subangular blocky structure; friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

2C4—48 to 66 inches; strong brown (7.5YR 5/6) fine sandy loam; massive; faint bedding planes; very friable; mildly alkaline.

Bedding planes are in the 10- to 40-inch control section.

The A horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 or 4, and chroma of 4 to 6. It is 3 to 10 inches thick. Reaction ranges from slightly acid to moderately alkaline. The 2Ab horizon is fine sandy loam, very fine sandy loam, loam, silt loam, or silty clay loam. Reaction ranges from neutral to moderately alkaline. Some pedons do not have a 2Ab horizon.

The C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. The texture is loamy very fine sand, very fine sandy loam, fine sandy loam, or silt loam. Reaction ranges from neutral to moderately alkaline. Buried horizons are common below a depth of 40 inches.

Ruston Series

The Ruston series consists of well drained, moderately permeable soils that formed in thick, loamy stream deposits of Tertiary and Pleistocene age. These soils are on uplands. Slopes range from 1 to 5 percent. Soils of the Ruston series are fine-loamy, siliceous, thermic Typic Paleudults.

Ruston soils are similar to Cahaba soils and commonly are near Briley, Malbis, Sacul, and Smithdale soils. Briley soils are in positions similar to those of the Ruston soils, and they have a thick sandy surface layer. Cahaba soils are on low terraces and have a solum that is thinner than the solum in the Ruston soils. Malbis soils are on slightly less convex slopes and have more than 5 percent plinthite in the subsoil. Sacul soils are on lower side slopes and in positions similar to those of the Ruston soils, and they have a clayey subsoil. Smithdale soils are on side slopes and do not have a profile with a bisequum.

Typical pedon of Ruston fine sandy loam, 1 to 5 percent slopes; about 5.5 miles northeast of Clarence, 3.7 miles east from Clarence on Highway 84, 7 miles north on Highway 1226, 0.4 mile southeast on dirt road, 350 feet north of dirt road; SE1/4SW1/4 sec. 36, T. 11 N., R. 6 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; very friable; common fine and very fine roots; slightly acid; clear smooth boundary.

E—4 to 12 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak medium subangular blocky structure; very friable; common fine roots; many fine pores; slightly acid; clear smooth boundary.

Bt1—12 to 21 inches; yellowish red (5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; friable; thick continuous clay films on faces of peds; common fine roots; few fine pores; medium acid; clear wavy boundary.

Bt2—21 to 31 inches; yellowish red (5YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable; few fine spots of light yellowish brown (10YR 6/4) sandy loam; thick discontinuous clay films on faces of peds; strongly acid; clear wavy boundary.

B/E'—31 to 36 inches; yellowish red (5YR 5/6) loam (Bt); few fine distinct red (2.5YR 4/6) mottles; common streaks and pockets of light yellowish brown (10YR 6/4) sandy loam (E); weak medium subangular blocky structure; friable; few thin patchy clay films on faces of peds; few fine pores; very strongly acid; clear wavy boundary.

B't—36 to 62 inches; yellowish red (5YR 5/6) sandy clay loam; common medium light gray (10YR 7/2) mottles; weak medium subangular blocky structure;

firm; thin patchy clay films on faces of peds; very strongly acid.

The solum is more than 60 inches thick. The B/E' horizon is definitive for the series. Quartz gravel or ironstone fragments are within the solum of some pedons. The effective cation exchange capacity is 20 to 50 percent saturated with exchangeable aluminum within a depth of 30 inches.

E—2 to 10 inches; brown (10YR 5/3) fine sandy loam; weak fine subangular blocky structure; very friable; many fine and medium roots; strongly acid; clear smooth boundary.

Bt1—10 to 20 inches; red (2.5YR 4/8) clay; strong medium angular blocky structure; very firm; common fine roots; continuous clay film on faces of peds; strongly acid; clear smooth boundary.

Bt2—20 to 28 inches; red (2.5YR 4/8) clay; common mottled in shades of brown, red, and gray. The texture is silty clay loam, clay loam, sandy clay loam, or silt loam.

The C horizon is mottled in shades of red, yellow, and

The A horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. It is 3 to 16 inches thick. Reaction is mildly alkaline or moderately alkaline.

Bx2—47 to 70 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct yellowish red (5YR 4/6) and light gray (10YR 7/2) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; firm and brittle; strongly acid.

The solum ranges from 60 to 90 inches in thickness. Depth to the fragipan ranges from 20 to 36 inches. The effective cation exchange capacity is 20 to 50 percent saturated with exchangeable aluminum within a depth of 30 inches.

The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2; or value of 4 or 5 and chroma of 2 or 3. It is 3 to 8 inches thick. Reaction ranges from very strongly acid to slightly acid.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is silt loam, very fine sandy loam, or loam. Reaction ranges from very strongly acid to medium acid. Some pedons do not have an E horizon.

Some pedons have a BE horizon that has hue of 10YR, value of 5, and chroma of 4 to 8. The texture is silt loam or loam. Reaction ranges from very strongly acid to medium acid.

The Bt horizon has the same range in color as that of the BE horizon, and in addition, it has hue of 7.5YR. The texture is clay loam, silty clay loam, loam, or silt loam. Reaction ranges from very strongly acid to medium acid. The Bt horizon has more than 25 percent sand with less than 15 percent coarser than very fine sand.

The Bx horizon has hue of 10YR or 7.5YR, value of 5

and are poorly drained. Kisatchie and Sacul soils are in positions similar to those of the Smithdale soils, and they have a fine-textured subsoil. Malbis soils are on gently sloping ridgetops and have a browner subsoil. Ruston soils are on gently sloping ridgetops and have a bisequum in the profile.

Typical pedon of Smithdale fine sandy loam, 8 to 20 percent slopes; about 4 miles northwest of Goldonna, 3.5 miles northwest on Highway 479 from its junction with Highway 156, 0.7 mile west on U.S. Forest Service Road 524 to road junction, 200 feet west of junction; SW1/4NE1/4 sec. 10, T. 12 N., R. 6 W.

A—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; very friable; common fine and medium roots; slightly acid; clear smooth boundary.

BE—9 to 16 inches; brown (7.5YR 4/4) fine sandy loam; weak medium granular structure; very friable; common fine and medium roots; medium acid; clear smooth boundary.

Bt1—16 to 33 inches; red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; friable; few fine roots; thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—33 to 46 inches; red (2.5YR 4/6) sandy clay loam; weak medium subangular blocky structure; very friable; thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—46 to 66 inches; red (2.5YR 4/8) sandy loam; weak pale brown to brownish yellow sand grains. The texture is sandy clay loam, sandy loam, or loam. The Bt horizon in some pedons has chert or ironstone gravel that constitutes as much 10 percent of the volume. Reaction of the Bt horizon ranges from very strongly acid to medium acid.

Wrightsville Series

capacity is 20 to 50 percent saturated with exchangeable aluminum within a depth of 30 inches.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2. It is 1 to 5 inches thick.

The Eg horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2; or hue of 2.5Y, value of 6 or 7, and chroma of 2. The texture is silt, silt loam, or silty clay loam. Tongues of Eg material extend into the Bt horizon. The Eg horizon is 13 to 26 inches thick.

firm; common fine roots; few fine black concretions of iron and manganese; neutral; abrupt smooth

very firm; few fine concretions of iron and manganese; neutral.

Formation of the Soils

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This section explains soil genesis and the processes and factors of soil formation as they relate to the soils of Natchitoches parish.

The Genesis of the Soils

Soil genesis is that phase of soil science that deals with the processes and factors of soil formation. It is the study of the formation of soils on the land surface and changes in soil bodies and is the science of the evolution of soils that are conceived of as natural units *(11, 27)*.

Soils are influenced by internal and external forces. The internal forces generally are synonymous with soil-forming processes, and the external forces with soil-forming factors. Soils generally are perceived to be a stable component of our environment because very little change is evident unless the soils are disturbed. Soil scientists, however, view soils as a dynamic system and may observe minute but important changes in the composition of the soil, depending upon when and how samples are taken. The following information should give a better understanding of how the soil survey can be used and how interpretations can be derived from it.

Processes of Soil Formation

The complex soil-forming processes can be described as the gains, losses, translocations, and transformations occurring in soils that influence the kind and degree of development of soil horizons *(29)*. Soil-forming processes result in additions of organic, mineral, and gaseous materials to the soil; losses of these same materials from the soil; translocations of materials from

surface horizon, the surface horizon is higher in organic matter content and darker than the lower horizons. The Armistead, Caspiana, Latanier, and Moreland soils have a dark surface horizon as a result of significant additions of organic matter.

The content of organic matter in soils can be maintained or increased by leaving crop residue and allowing leaf litter and other organic material to accumulate. These accumulations are decomposed and mixed into the soil mainly by the activity of living organisms. Increasing the content of organic matter in soils significantly decreases their erodibility.

The additions of mineral material on the surface has been important in the formation of some soils in Natchitoches Parish. The added material, generally in the form of alluvium, provides new parent material in which the processes of soil formation can occur. In many cases, accumulation of new material has been faster than the processes of soil formation could appreciably alter the material. This is evident as depositional strata in the lower horizons of many of the soils that developed in alluvial sediment. Although most of the soils in Natchitoches Parish formed in alluvial parent material, the depositional strata are evident only in the Roxana and Severn soils. These soils are forming in recent or relatively young alluvial sediment. Materials added to soils in the form of liquids or gases are generally compounds of nitrates and sulfates that are dissolved or trapped in rainwater.

Loss of components from the soil is less noticeable than most additions to the soil during soil formation, but they are important in the overall process of soil development. For example, when organic matter is decomposed, carbon dioxide is emitted into the atmosphere. Water also escapes from the soil by evaporation and transpiration from plants. Erosion leaching of most soluble bases in a relatively short time. In less permeable and more clayey soils, water from rainfall moves slowly through the soil and leaching is less pronounced. In some pedons of the Gore, Latanier, Moreland, Morse, and Perry soils, most of the free carbonates that were initially present remain in the soil, but they have been leached from the upper part of the profile to the lower part. Where rainfall is sufficient, however, the soluble elements in these less permeable soils may be completely leached out of the soil profile. The effects of leaching are least pronounced in soils developed in relatively young parent material that was initially high in bases, such as the Roxana and Severn soils. Also, in most areas of the Severn soils, alluvial sediment high in carbonates is added to the surface almost yearly.

The translocation of material in the soil has been an important process during the development of most of the soils in the parish. Eluviation is the movement of solids out of part of the soil profile, and the illuviation is the movement of solids into a lower part of the soil profile. In soils that have large pores, soil material small enough to go through these pores can be suspended in water as it moves downward. Clay particles, because of their small size, are moved downward in this manner. In Natchitoches Parish, the translocation and accumulation of clay in the profile is evident in the Anacoco, Cahaba, Gallion, Ruston, Smithdale, and Wrightsville soils.

Many soils in the parish exhibit the movement of iron and manganese and an accumulation of these in the lower part of the profile. These accumulations are the result of alternating oxidizing and reducing conditions associated primarily with fluctuating water-saturated zones within the soils. Reducing occurs when the soil is saturated with water for relatively long periods and when low amounts of oxygen are in the soil. Reduced compounds of iron and manganese result in gray colors characteristic in the Bg and Cg horizons in the Caddo and Guyton soils. If the reduced conditions are prevalent for a sufficient time and if the level of the water table is fluctuating, the iron and manganese may be translocated to a lower horizon and precipitated at the top of the saturated zone. Brownish or reddish mottles in grayish horizons are common in the Beauregard, Keithville, Malbis, Sacul, and Wrightsville soils.

The transformations of mineral and organic substances in soils is also a major process in soil formation. Some transformations in soil are referred to as geochemical weathering. Processes that take place as part of geochemical weathering are oxidation, reduction, combinations of these in alternating cycles, hydration, solution, and hydrolysis. Oxidation is a geochemical reduction that occurs in well aerated soils and parent material. The most easily recognized oxidation reaction is that of the oxidation of the ferrous ion to the ferric ion. This process is most common in mineral species of high iron-bearing hornblends and pyroxenes of the primary mineral group and in soils in which glauconite or siderite compose a part of the parent material. Oxidation is an important soil-forming process in the Natchitoches soils that contain both glauconite and siderite.

Hydration is the union of water molecules or hydroxyl groups with minerals without being a part of the mineral itself. It occurs primarily on the surfaces or edges of mineral grains, or it can be part of the structure as in simple salts. An excellent example of this chemical reaction is the hydration of anhydrite to form the mineral. Gypsum is commonly in clayey soils in which there is a source of sulfate, presumable from a marine environment, and a source of calcium, either from the sediments themselves or from mineral weathering. The Kisatchie and Morse soils can contain gypsum.

Hydrolysis is the chemical reaction of the hydrogen ion with individual elements within crystal structures. The highly reactive hydrogen ion replaces one of the basic ions in the structure of the mineral. Hydrolysis generally is the most important chemical weathering process and results in a complete disintegration of primary minerals in all soils. This process makes plant nutrients available to plants.

Solution is the simple process of dissolving salts, such as carbonates and sulfates. As water moves through the soil, the dissolved salts can be removed from the soil system or deposited at a lower depth. The accumulation of carbonates and sulfates (gypsum) in a soil horizon is indicated by subscripts "k" (carbonates) and "y" (gypsum). Examples are the Bk1 and Bk2 horizons in the Moreland series.

Several hypotheses have been offered to explain the formation of fragipans in soils. Either chemical or physical reactions, or both, have resulted in their formation. Fragipans are dense, brittle layers in the subsoil of some soils, such as the Shatta soils. The material is dense and has many vesicular pores, but it restricts water movement.

Factors of Soil Formation

The character and development of soils are controlled by external factors *(14)*. A study of these factors can be a great help in understanding the genesis of soils. A factor of soil formation is an agent, force, condition, relationship, or a combination of these that influence or influenced parent material *(11)*. Soils are a function of five factors that define the state and history of soil systems—climate, organisms, parent material, relief, and time *(21)*. The factors define the soil system in terms of variables that control the characteristics of the system and not in terms of processes, causes, or forces that are active in the system. These soil forming factors

Climate

Detailed information on the climate in Natchitoches Parish is given in the section "General Nature of the Survey Area."

Rainfall and temperature are the most commonly measured features of climate that have been most closely correlated to soil properties *(11)*. Although

forming processes. Van't Hoff's temperature rule, "for every ten degrees rise in temperature the speed of a chemical reaction increases by a factor of two to three," is true in soil-forming processes *(38)*. Solar radiation generally increases with elevation. The rate of increase is most rapid in the lower, dust-filled layers of the air. The absorption of solar radiation at the soil surface is other factors, such as temperature and rainfall. Under conditions optimal for microbial activity, organic matter production and decomposition are in equilibrium. Accumulation will not occur unless there is a change in

hardwoods are more prevalent on north-facing slopes, whereas pine or mixed pine and hardwoods occur on south-facing slopes.

Relief also affects the moisture relationships in the morphological entity may be a consequence of a combination of several genetic factors, and the morphological expression of soil processes may be a result of several pathways. For example, if a soil begins to form from loamy parent material on gently sloping uplands of pine forest in a climate similar to that of the present, the soil might progress in the formation of a darkened surface horizon because of the accumulation of organic carbon. The subsoil might develop sequentially with a cambic argillic horizon with the formation of an E horizon as the argillic formed. A soil similar to the Ruston soils may result. As long as the factors associated with parent material, climate, organisms, and relief did not change substantially with time, the soil would have formed sequentially. It is possible, however, for the factors to have changed. When some major factor changes, time as a factor of formation returns to zero. However, because the morphological expressions of the factors during that period of time could remain, the total amount of time might not appear to differ from one soil to another.

Several methods are available in which actual dates may be obtained from soils; however, morphological properties are most commonly used to determine the age of soils. For example, the Betis soils that have a thick E horizon would normally be considered older than the Sacul soils that have a relatively thin E horizon. However, other factors, such as parent material, climate, and living organisms, also play an important role in horizon thicknesses. On a gross scale, geology can be used as an indicator of the relative age of the soil. One [illegible]

Recent Flood Plains and Terraces

The soils on the flood plains formed in Holocene and late Pleistocene terrace alluvial deposits of the Red River, Saline Bayou, and many small streams that drain the uplands.

The flood plains of the Red River and its tributaries and distributaries make up about 28 percent of the parish. The width of the flood plain is less than 4 miles at its narrowest point just north of Natchitoches and more than 16 miles at its widest point. The Red River north of Natchitoches has been forced into a narrow channel by resistant Tertiary beds that prevented the channel and river valley from becoming wider. These beds are also exposed in the northeastern part of the parish.

The most recent and highest natural levees of the Red River alluvial plain are those flanking the present channel. Levees on the western side of the river, north of the restriction caused by the Tertiary beds, are better developed than those on the eastern side. They have not been constricted or hampered by the proximity of the valley wall. In areas where the river approaches the valley wall, the levees are narrow and the back slopes are steep and well developed. Rim swamps are numerous. The average height of the levees is about 10 feet, but they reach a maximum height of not more than 15 feet above the backswamps. The slope from the crest of the Red River natural levees to the backswamps is between 3 and 4 feet per mile.

The Red River raft was a great log jam that choked and Moreland-Lantanier-Armistead general soil map units formed in the alluvial plain of the Red River.

The Roxana and Severn soils are associated with natural levees. The Severn soils are on the natural levees and low sandbars between the Red River and the high manmade levees along the river. The soils between the levee and the river channel are subject to occasional or frequent flooding and receive increment additions of sediment each year. The Roxana soils are in high positions on natural levees adjacent to the Red River and its former channels and distributaries. These soils are protected from flooding by a network of levees. The Severn soils typically are calcareous higher in the profile than the Roxana soils.

The Gallion soils formed in loamy alluvium on natural levees of former channels of the Red River. These soils exhibit the facies of a natural levee associated with a

sediments is not associated with the Red River. The Lotus and Guyton soils formed in recent alluvial sediment associated with the present drainage systems. These drainage systems are narrow, have weakly expressed natural levees, and are subject to flooding by runoff from the uplands. The Guyton soils are in the drainageways and are fine-silty. The Lotus soils are on sandy natural levees along drainageways of the sandy uplands. The Lotus soils formed on sandy natural levees along Spring Branch and Cypress Branch of Devil's Creek. The sands were probably eroded from the Betis and Briley soils on uplands.

The Bienville and Cahaba soils formed on terraces that are slightly higher than the flood plains. These terraces are associated with drainageways of the Tertiary and older Pleistocene uplands. The Bienville soils are sandier than the Cahaba soils.

mixture of T2 and T3 sediments. Because the soil contains a fragipan, which is more resistant to erosion than most subsoils, the soil is in an intermediate position between the T2 and T3 terraces. Sediments from the Red River and the mid-continental glaciation probably are the parent material for the Shatta soils. There may be a loess component since the Shatta is siltier than any

that were incorporated with fluvitile sediments. Tilting of the land coincided with the downwarping of the continental margin of the Gulf Coast geosyncline and upwarping of the Sabine Uplift. These events exposed the Wilcox sediments in Natchitoches Parish *(4)*.

Extensive faulting has accompanied the Sabine Uplift, which further confuses the soil-geology relationship are similar to the Keithville soils except they have clayey horizons nearer the surface and are thinner because of erosion. The Bellwood soils are generally in a lower position on the landscape than the Keithville, Oula, and Kisatchie soils. The Bellwood soils formed in very fine marine clay deposited as lagoonal clay. Because of the fineness, mineralogy of the clay, and side slope position, profile development has been minimal. The original

uplifting, the sediments occur at several elevations. The Sacul soils are generally on side slopes at a lower elevation than the other clayey Tertiary soils. The acidity and aluminum saturation are indications that the original sediments were backwater and overflow deposits that contained pyrite. The upper horizons are reddish and are in a well oxidized zone. The lower horizons are grayish

References

(1) Adams, F. 1984. Soil acidity and liming. Agron. Mono. 12, 2nd ed. Am. Soc. Agron.

(2) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vol., illus.

(3) American Society for Testing and Materials. 1986. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(4) Anderson, H.V. 1960. Geology of Sabine Parish. La. Dep. Conserv. Geol. Surv. Bull. 34, 164 pp.

(13) Coleman, S.M. 1981. Rock-weathering rates as function of time. Quant. Res. 15:250-264

(14) Crowther, E.M. 1953. The sceptical soil chemist. J. Soil Sci. 4:107-122.

(15) Davis, W.M. 1899. The geographical cycle. Geograph. J. 14:481-504.

(16) Fisk, H.N. 1940. Geology of Avoyelles and Rapides Parishes. La. Geol. Surv. Geol. Bull. 18, 239 pp.

(17) Hack, J.T. 1960. Interpretations of erosional topography in humid temperate regions. J. Am. Sci.

(26) Murray, G.E. 1955. Midway Stage, Sabie Stage and Wilcox Group. Am. Assoc. Petrol. Geol. Bull. 39:671-689.

(27) Pomerening, J.A. and E.G. Knox. 1962. A test for natural soil groups within the Willamette Catena population. Soil Sci. Soc. Am. Proc. 26:282-287.

(28) Pope, D.E. 1980. Composite columnar section of Louisiana. La. Geol. Surv.

(29) Simonson, Roy W. 1959. Outline of a generalized theory of soil genesis. Soil Sci. Soc. Am. Proc. 23: 152-156, illus.

(30) Stevenson, F.J. 1982. Humus chemistry.

(31) Stevenson, F.J., 1982. Nitrogen in agricultural soils. Agron. Mono. 22. Am. Soc. Agron.

(32) United States Department of Agriculture. 1951 (Being revised). Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. (Supplements replacing pp. 173-188 issued May 1962.)

(33) United States Department of Agriculture. 1975. Forest statistics for Louisiana parishes. Forest Serv., South. Forest Exp. Stn. Resour. Bull., pp. 50-52.

(34) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., Agric. Handb. 436, 754 pp., illus.

(35) United States Department of Agriculture. 1978. Procedure to establish priorities in landscape architecture. Soil Conserv. Serv. Tech. Release 65.

(36) United States Department of Agriculture. 1984. Procedures for collecting soil samples and methods of analysis for soil survey. Soil Surv. Invest. Rep. 1, 68 pp., illus.

(37) United States Department of Agriculture. 1985. Site index and yield of second growth baldcypress. Soil Conserv. Serv., Tech. Note No. 5, 2 pp.

(38) Van't Hoff, J.H. 1884. Etudes de Dynamique Chimique. (Studies of dynamic chemistry).

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5

carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels, i.e., clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered

Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are

within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system. into an area without controlled distribution.

Large stones (in tables). Rock fragments that are 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil

Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). In these areas, surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the in organic matter content than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils

loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An therwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.